Report

on

Approval of Capital Cost

of 113 MW Rongnichu Hydro Power Project

Report submitted on: 10th June 2025

Client: Chhattisgarh State Electricity Regulatory Commission

Developer: Madhya Bharat Power Corporation Limited

Report Prepared by: ABPS Infrastructure Advisory Private Limited.

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Abbreviations

ASTM	American Society for Testing and Materials
BIS	Bureau of Indian Standards
BOOT	Build, Own, Operate and Transfer
BOQ	Bill of Quantities
BRO	Border Roads Organization
CAT	Catchment Area Treatment
CIP	Capital Investment Plan
COD	Date of Commercial Operation
CSERC	Chhattisgarh State Electricity Regulatory Commission
CSPDCL	Chhattisgarh State Power Distribution Company Limited
DMMG	Department of Mine, Minerals and Geology
DPR	Detailed Project Report
FoC	Face of Concrete
FY	Financial Year
GIS	Gas Insulated Substation
GJM	Gorkha Janmukti Morcha
GoS	Government of Sikkim
GST	Goods and Service Tax
HEP	Hydro Electric Plant
HM	Hydro Mechanical
HRT	Head Race Tunnel
IA	Implementation Agreement
ICB	International Competitive Bidding
IDC	Interest During Construction
IEDC	Incidental Expenses During Construction
kV	Kilo Volt
LHPS	Lower Horizontal Pressure Shaft
LoI	Letter of Intent
MBPCL	Madhya Bharat Power Corporation Ltd
MVA	Mega Volt Ampere
MW	Mega Watt
MYT	Multi Year Tariff
NDT	Non Destructive Testing
NH	National Highway
NoC	No objection Certificate
PCC	Plain Cement Concrete
PGCIL	Power Grid Corporation of India Limited
PPA	Power Purchase Agreement
PPV	Penstock Protection Valve
PVC	Poly Vinyl Chloride
PWD	Public Works Department
RCC	Reinforced Concrete Cement
SCOD	Scheduled Commercial Operation Date
SEML	Sarda Energy and Minerals Ltd.
SFRS	Steel Fiber Reinforced Shotcrete

SPDCL	Sikkim Power Development Corporation Limited
SPV	Special Purpose Vehicle
STU	State Transmission Utility
TEC	Techno Economic Clearance
TREL	Texmaco Rail & Engineering Ltd.
TVS	Technical Validation Session
UHPS	Upper Horizontal Pressure Shaft
VPS	Vertical Pressure Shaft

1 INTRODUCTION

1.1 Background

1.1.1 M/s Madhya Bharat Power Corporation Ltd. (MBPCL) is a Generating Company under Section 2(28) of the Electricity Act, 2003 (the Act). MBPCL is a Special Purpose Vehicle (SPV) of Sarda Energy and Minerals Ltd. (SEML) and has developed a run of river 113 MW (2x56.5 MW) Rongnichu Hydro Power Project (the Project) on Rongnichu river in East Sikkim with details of unit-wise Date of Commercial Operation (COD) of the Project as below:

Table 1: Actual date of Commercial Operation of Units

Unit	Actual COD
Generating Unit #1	**25.06.2021**
Generating Unit #2	**30.06.2021**

1.1.2 The PPA dated 04.01.2020 was signed between MBPCL and Chhattisgarh State Power Distribution Company Limited (CSPDCL) for a period of thirty-five (35) years for purchase of power from Rongnichu Hydro Electric Project. The relevant extracts of the PPA regarding the Tariff are reproduced as below:

> *" **10 ARTICLE – 10: ENERGY PURCHASE AND SALE***
> ***10.1 Tariff and Sale of Energy by the Supplier:***
> *10.1.1 The Procurer shall purchase the number of Units in accordance with the provisions of Article 6.10.*
> *10.1.2 The **"Tariff"** for supply of Contracted Energy in any Contract Year shall be the tariff as determined by CSERC.*
> *10.1.3 The Supplier shall ensure exclusive sale of the Contracted Energy to the Procurer and shall not sell such Contracted Energy at any time to any third party during the period of this Agreement, subject to the provisions of Article 11.5."*

1.1.3 In line with the PPA clause on determination of Tariff by the Hon'ble Chhattisgarh State Electricity Regulatory Commission (Hon'ble Commission or CSERC) and considering the Actual COD, the Hon'ble Commission passed the Order dated 22.09.2021 and determined the Provisional Tariff for sale of power by MBPCL to CSPDCL from actual COD up to 31.03.2022.

1.1.4 MBPCL has filed a Petition (P. No. 93/2022) before the Hon'ble Commission for approval of final capital cost of the project as on COD, i.e., 30.06.2021 in accordance with CSERC (Terms and Conditions for determination of tariff according to Multi-Year Tariff principles and Methodology and Procedure for determination of Expected

revenue from Tariff and Charges) Regulations, 2015 and amendments thereof.

1.1.5 The Hon'ble Commission vide daily Order dated 07.12.2022 admitted the Petition and reserved the Order.

1.1.6 The Hon'ble Commission appointed M/s ABPS Infrastructure Advisory Private Limited (ABPS Infra) for assisting the Hon'ble Commission in approval/vetting of Capital Cost and Capital Investment Plan of 113 MW (2x56.5 MW) Rongnichu Hydro Electric Project of MBPCL.

1.1.7 Accordingly, this instant Report has been prepared by M/s ABPS Infrastructure Advisory Private Limited on detailed prudence check of Capital Cost and Capital Investment Plan of 113 MW (2x56.5 MW) Rongnichu Hydro Electric Project of MBPCL.

1.1.8 The Chronology of Events of the project and this Petition are as follows:

Table 2: Chronology of Events

S. No.	Event	Date
1.	LoI issued by Govt. of Sikkim (GoS) to MBPCL	01.03.2005
2.	Implementation Agreement by MBPCL	01.03.2006
3.	DPR approved by GoS for 96 MW Hydel Project	01.10.2008
4.	NoC provided by GoS for enhancement to 113 MW	26.07.2019
5.	PPA Executed with CSPDCL for 96 MW	04.01.2020
6.	TEC provided by GoS for the enhanced project capacity (113 MW)	15.06.2020
7.	PPA approved by the Hon'ble Commission and amendment allowed for enhancement for 113 MW	31.03.2021
8.	Supplementary PPA entered between MBPCL and CSPDCL	28.05.2021
9.	COD of Unit I	25.06.2021
10.	COD of Unit II	30.06.2021
11.	Provisional Tariff approved by the Hon'ble Commission vide Order in Petition No. 22 of 2021	22.09.2021
12.	Instant Petition filed by MBPCL for: • Final Capital Cost of the Project as on COD (i.e. 30.06.2021); • Final Tariff/Truing-Up of tariff for the period from actual COD till 31st March 2022; • Capital Investment Plan (CIP) for 4th control period i.e. from FY 2022-23 to FY 2024-25; • MYT for 4th control period i.e. from FY 2022-23 to FY 2024-25.	08.11.2022
13.	1st Additional Information raised	27.09.2023
14.	Replies to 1st Additional Information submitted vide letters	04.11.2023, 08.11.2023, 01.12.2023
15.	1st Technical Validation Session (TVS) held with MBPCL	15.04.2024
16.	2nd Additional Information raised after TVS	16.04.2024

S. No.	Event	Date
17.	Response to 2nd Additional Information submitted vide letters	01.05.2024, 03.05.2024, 06.05.2024, 14.05.2024, 15.05.2024, 29.05.2024
18.	3rd Additional Information raised	29.05.2024
19.	2nd Technical Validation Session (TVS) held with MBPCL	03.06.2024
20.	Response to Additional Information raised after TVS	06.06.2024
21.	Additional Information on Milestone-wise delay	15.05.2025

2 Capital Cost of 113 MW Hydro Power Plant Project

2.1 Background of Capital Cost of 113 MW Hydro Power Plant Project

2.1.1 On 01.03.2005, the Government of Sikkim (GoS) issued Letter of Intent (LoI) to MBPCL for implementation of the 95 MW Rongnichu Hydro Power Project on Build, Own, Operate and Transfer (BOOT) basis. MBPCL vide letter dated 06.05.2005, confirmed its acceptance for implementation of the Project. The project was later conceived to be of 96 MW Capacity.

2.1.2 On 01.03.2006, MBPCL entered into an Implementation Agreement (IA) with GoS for the development of 96 MW Rongnichu Hydro Electric Project.

2.1.3 In March 2005, MBPCL engaged independent agency to carry out broad geo-technical site investigation, topographic survey and engineering studies in order to prepare Detailed Project Report (DPR) of the Project, for obtaining approval from GoS.

2.1.4 The DPR was approved and Techno-Economic Clearance (TEC) was granted on 01.10.2008 by the Energy & Power Department, GoS for project capacity of 96 MW and with an estimated cost of Rs. 492.32 Crore (±25%) and a Scheduled COD of March 2012.

2.1.5 After grant of TEC, GoS started the land acquisition process on 03.11.2008 and the award of Land to MBPCL was made on 15.11.2010. Subsequently after construction of the approach roads and availing all the pre-requisite approvals and clearances, the Project implementation works started in October, 2010.

2.1.6 MBPCL has submitted that at various stages of implementation of the project, changes in certain components as mentioned hereunder became inevitable primarily due to geological reasons and also considering local public sentiments, safety during construction, and other ground realities:

a) Change in location of Barrage;
b) Increase in Number of ADITS;
c) Change in Location of ADITS;
d) Change in shape of HRT from horse shoe to D-shaped;
e) Change in Finished Dia of HRT;

f) Re-alignment of HRT;
g) Increase in Length of HRT;
h) Re-alignment of Penstock;
i) Change in Power Evacuation System;
j) Enhancement of Station capacity from 96 MW to 115 MW.

2.1.7 The aforementioned changes were incorporated in the 1st Supplementary Detailed Project Report (DPR), along with the revised capital cost, which was approved by GoS on 24.07.2012. Subsequently, the 2nd Supplementary DPR, including the revised capital cost, received approval from GoS on 07.04.2016. The 3rd Supplementary DPR, along with its revised capital cost, was approved by GoS on 15.06.2020.

2.1.8 The 2nd Supplementary DPR, with a revised estimated cost of Rs. 1,187.48 Crore and the 3rd Supplementary DPR, with a revised estimated cost of Rs. 1,453.34 Crore (±25%), were submitted for consideration to Financial Institutions and the Energy and Power Department of GoS. The Financial Institutions, in their Information Memorandum dated 10.08.2015, and Sanction Letter dated 25.09.2019, approved the proposed capital costs of Rs. 1,187.48 Crore and Rs. 1,453.34 Crore, respectively.

2.1.9 On completion of the Project, MPBCL submitted the revised DPR (As Built Project Completion Report) along with the duly audited and certified final completion cost of the project. GoS, after examination vide letter dated 12.07.2022, has approved the revised DPR (As Built Project Completion Report) and approved final project cost of Rs. 1,612.30 Crore as on COD.

Table 3: Capital Cost Variation (Rs. Crore)

Particulars	DPR				Total Variation
	Original	1st Revision	2nd Revision	3rd Revision (Final)	
Hard Cost	446.62	885.78	1,075.77	1,082.62	636.00
IDC	45.70	301.70	377.57	529.68	483.98
Total	**492.32**	**1,187.48**	**1,453.34**	**1,612.30**	**1,119.98**

2.1.10 The sub-head wise break-up with respect to original Capital cost and final Capital Cost is as follows:-

Table 4: Capital Cost Original w.r.t to Final Capital Cost (Rs. Crore)

Description	Original Approved estimated Cost	Final Audited Cost incurred	Difference
CIVIL WORKS			
I – Works			
A – Preliminary	10.00	20.50	10.50
B – Land	10.00	25.62	15.62
C - WORKS	35.71	109.05	73.34
J - WORKS - CONVEYANCE & POWERHOUSE	155.15	514.52	359.37
K - BUILDINGS	7.51	2.52	-4.99
M - PLANTATION	0.60	0.63	0.03
O - MISCELLANEOUS	5.40	10.59	5.19
Q - SPECIAL TOOLS AND PLANT	3.22	1.90	-1.32
R – COMMUNICATION (OTHER INFRASTRUCTURE)	12.77	43.78	31.01
X - ENVIRONMENT AND ECOLOGY	5.00	6.50	1.50
Y. Losses on stock @ 0.1% of (I-Works less A, B, M, O, Q, X and P)	0.21	0.00	-0.21
Total I- WORKS	**245.58**	**735.61**	**490.03**
II - Establishment @ 8% Cost of I-Works	19.65	71.48	51.83
III - Tools and Plants @ 1% Cost of I-Works	2.46	1.52	-0.94
Total Civil Cost	**267.69**	**808.61**	**540.92**
E&M Works excluding Transmission Lines	112.1	153.12	41.02
Transmission Lines	20.06	35.91	15.85
Total Construction Cost	**399.85**	**997.64**	**597.79**
Escalation Cost	46.77	84.99	38.22
Total Project Cost Before IDC	**446.61**	**1,082.63**	**636.02**
Interest During Construction	45.71	529.68	483.97
Total Cost Including Escalation & IDC	**492.32**	**1,612.31**	**1,119.99**

2.1.11 The capital costs claimed under the above heads have been analysed, and observations on factors contributing to Cost and Time Overrun are detailed in the subsequent sections.

3 Regulatory Regime

3.1 Capital Cost

3.1.1 The relevant Regulations on approval of the Capital Cost as per the Chhattisgarh State Electricity Regulatory Commission (Terms and Conditions for determination of tariff according to Multi-Year Tariff principles and Methodology and Procedure for determination of Expected revenue from Tariff and Charges) Regulations, 2015 (hereinafter referred to as Tariff Regulations, 2015)are reproduced below:

> *"18. CAPITAL COST AND CAPITAL STRUCTURE*
> *18.1. Capital cost for a project shall include:*
> *(a) the expenditure incurred or projected to be incurred, including interest during construction, incidental expenses during construction and financing charges, any gain or loss on account of foreign exchange risk variation during construction on the loan, up to the date of commercial operation of the project, as admitted by the Commission, after prudence check;*
> *(b) Interest during construction (IDC)*
> *i. Interest during construction shall be computed corresponding to the loan from the date of infusion of debt fund, and after taking into account the prudent phasing of funds up to SCOD.*
> *ii. In case of additional costs on account of IDC due to delay in achieving the SCOD, the generating company or STU/ transmission licensee or distribution licensee or SLDC as the case may be, shall be required to furnish detailed justifications with supporting documents for such delay including prudent phasing of funds;*
> *iii. Provided that if the delay is not attributable to the generating company or STU/transmission licensee or the distribution licensee or SLDC as the case may be, and is due to uncontrollable factors as specified in Regulation 11 of these regulations, IDC may be allowed after due prudence check:*
> *Provided further that only IDC on actual loan may be allowed beyond the COD to the extent, the delay is found beyond the control of generating company or the transmission licensee or distribution licensee or SLDC, as the case may be, after due prudence and taking into account prudent phasing of funds.*
> *(c) Incidental Expenditure during Construction (IEDC):*
> *i. Incidental expenditure during construction shall be computed from the zero date and after taking into account pre-operative expenses up to SCOD:*
> *Provided that any revenue earned during construction period up to SCOD on account of interest on deposits or advances, or any other receipts may be taken into account for reduction in incidental expenditure during construction.*
> *ii. In case of additional costs on account of IEDC due to delay in achieving the SCOD, the generating company or STU/ transmission licensee or distribution licensee or SLDC as the case may be, shall be required to furnish detailed justification with supporting documents for such delay including the details of incidental expenditure during the period of delay and liquidated damages recovered or recoverable corresponding to the delay:*
> *Provided that if the delay is not attributable to the generating company or STU/transmission licensee or distribution licensee or SLDC as the case may be, and is due to uncontrollable factors as specified in Regulation 11, IEDC may be allowed after due prudence check:*

Provided further that where the delay is attributable to an agency or contactor or supplier engaged by the generating company or STU/ transmission licensee or distribution licensee or SLDC, the liquidated damages recovered from such agency or contractor or supplier shall be taken into account for computation of capital cost.
In case the time over-run beyond SCOD is not admissible after due prudence, the increase of capital cost on account of cost variation corresponding to the period of time over run may be excluded from capitalization irrespective of price variation provisions in the contracts with supplier or contractor of the generating company or STU/ transmission licensee or distribution licensee or SLDC.
(d) in case of SLDC business, the capital cost appearing in the books of accounts of SLDC/STU as on the date of transfer along with the approved CAPEX plan for the control period shall be the basis for determination of charges.
(e) capitalized initial spares subject to the ceiling rates specified in Regulation 18.3; and
(f) additional capital expenditure determined under Regulation l9:
Provided that the assets forming part of the project, but not in use shall be taken out of the capital cost.
18.2. The capital cost admitted by the Commission after prudence check shall form the basis the determination of tariff:
Provided that prudence check may include scrutiny of the reasonableness of the capital expenditure, financing plan, IDC and IEDC, use of efficient technology, cost over-run and time over-run, and such other matters as may be considered appropriate by the Commission for determination of tariff;
Provided that where the actual capital cost is lower than the approved capital cost, the actual capital cost shall be considered for tariff determination. Any escalation in capital cost over and above the approved capital cost may be considered by the commission subject to prudence check or independently vetted by the Commission.
Provided that in case the site of a hydro generating station is awarded to a developer by a State Government by following a two stage transparent process of bidding, any expenditure incurred or committed to be incurred by the project developer for getting the project site allotted shall not be included in the capital cost:
Provided also that the capital cost in case of such hydro generating station shall include:
(a) cost of approved rehabilitation and resettlement (R&R) plan of the project in conformity with R&R package as approved; and
(b) cost of the developer's 10% contribution towards any development scheme such as RGGVY or DDUGJY etc, in the affected area:
Provided also that where the long-term power purchase agreement entered into between the generating company and the beneficiaries or the transmission service agreement entered into between the transmission licensee and the beneficiary, as the case may be, provide for ceiling of actual expenditure, the capital expenditure admitted by the Commission shall take into consideration such ceiling for determination of tariff.
18.3. The capital cost may include capitalized initial spares.
18.3.1. Generation utility
Initial spares shall be capitalized as a percentage of the plant and machinery cost, subject to following ceiling norms:
i. Coal-based/lignite-fired thermal generating stations - 4.00%
ii. Hydro generating stations - 4.00%
…
18.4. Any expenditure on replacement, renovation and modernization or extension of life of old fixed assets, as applicable to generating company, transmission licensee and distribution licensee, shall be considered after writing off the net value of such replaced assets from the original capital cost.

18.5. In case of de-capitalisation of assets of a generating company or the licensee, as the case may be, the original cost of such asset as on the date of de-capitalisation shall be deducted from the value of gross fixed asset and corresponding loan as well as equity shall be deducted from outstanding loan and the equity respectively in the year such de-capitatisation takes place, duly taking into consideration the year in which it was capitalised.

18.6. The average capital cost during a year shall be computed as average of opening and closing gross fixed assets for the year.

Provided that for the new generating station or unit, the capital cost shall be charged on pro-rata basis during the year for the asset declared under commercial operation and for subsequent years, the capital cost shall be computed on the average asset base."

3.1.2 Based on the above-mentioned Regulations, the Capital Cost till the COD of Unit 2 has been analysed as discussed in the subsequent sections.

4 Time Overrun for the Project

4.1 Background

4.1.1 The Project was approved by GoS vide Techno-Economic Concurrence (TEC) dated 01.10.2008. The estimated completion period of the Project at the inception was of 42 months from the date of grant of TEC. Thus, initially envisaged Scheduled COD was March 2012. However, Unit 1 and Unit 2 of the Hydro Electric Project were commissioned on 25.06.2021 and 30.06.2021, respectively. Thus, the total delay (Time Overrun) in achieving COD works out to 111 months. MBPCL has provided the following details regarding the time overrun of the Project.

4.2 Reasons for Time Overrun

4.2.1 The major reasons for time overrun as submitted by MBPCL are summarized below:

4.3 Land Acquisition

4.3.1 As per the conditions of Implementation Agreement executed between GoS and MBPCL, GoS in association with Sikkim Power Development Corporation shall acquire at the request and expense of MBPCL, private land required for Project and transfer the land for construction, operation and maintenance of the Project. However, despite the facilitation by the local authorities, hindrances in acquisition of private land led to extension of Project timelines.

- The process of identification jointly with the representative of District Collector, SPDCL and MBPCL for 14.920 Ha private land required for the project was taken up, thereafter the enumeration and assessment of standing crop properties on the identified land was done after due consultation with land owners.

- After completion of its process of internal approvals, the actual acquisition process was started by Government on 03.11.2008 (Notice u/s 4 of Land Acquisition Act, 1894).

- On 10/02/2009, 80% advance payment was made for Land (Namli, Sumin, Central Pandam, Yangtam and block of East District of Sikkim) amounting to INR 27,214,821.00 (including 1.5% Service Charges of SPDCL).

- On 21.08.2009, SPDCL informed that non-acceptance of land compensation by land owners in-spite of repeated requests by the project authorities is causing

delay in project implementation and requested District Collector to facilitate early transfer of the land.

- Thereafter, notification u/s 6 of Land Acquisition Act, 1894 was declared on 10.09.2009 by District Collector, East Sikkim.
- On 15.11.2010, Notice under Section 11 (Declaration Award) was published.
- On 25.04.2011, the balance 20% advance payment (Namli, Sumin, Central Pendam, Yangtam & Namchebong Blocks of East District of Sikkim) was made.
- As many of the landowners did not agree to part with their land, the acquisition process for only 11.3895 ha private land could be completed.
- Finally, on 27.04.2012, Lease Agreement for 11.3895 ha private land in Namli, Sumin, Central Pandam (Samsing and Zitland), Yangtam and Namchebong blocks of East District of Sikkim was executed between GoS and MBPCL.

4.3.2 MBPCL submitted that from the above, it may be observed that although award u/s 11 was made on 15.11.2010, there was a delay of about 17-18 months in giving possession of the land to MBPCL due to resistance from landowners. This also contributed to a considerable delay in commencement of work in important locations.

4.3.3 While necessary prudent initiatives were undertaken to resolve the matter with such private land owners, however, in order to avoid further time delays, further investigation were undertaken to identify alternative location for Adit and starting the acquisition process again. Time Extension in acquisition of land has occurred in:

- **Adit-1:** While the site for Adit -1 Approach road at Namcheybong was acquired following the due process, the land owner, however, refused to part with his land. A significant period of ~12 months lapsed in carrying out discussions/negotiations to take possession of this land. To avoid any further time extension, a new site at Nimtar was identified. Acquisition of land and construction of approach road delayed the start of Adit -1 by 1.5 years. Therefore, works, which were originally planned to start by October 2010 could actually be started by the end of March 2012.
- **Adit-2B (Old):** In order to reduce the construction time of 12.6 km long tunnel and for convenience of excavation and concreting of 5 km long stretch of tunnel between Adit-2 and Adit-3, a new Adit namely, Adit 2B at Sumin, was proposed between Adit-2 and Adit-3, which was not considered in the Original DPR, for facilitating proper ventilation during excavation and to facilitate reduction in

mucking time. However, in spite of persistent efforts since July 2011, a plot of land at the beginning of approach road to the proposed Adit 2B at Sumin could not be acquired till March 2015. Hence, an alternate location for Adit 2B portal had to be identified in June 2014.

- **Adit 2B (new):** The proposal for private land acquisition and Forest land adjustment was initially processed in December 2012. However, the same could be achieved only by June 2014 after rigorous follow-ups, meetings and discussions with the stakeholders.

4.3.4 MBPCL submitted that it undertook all the necessary and prudent steps to take possession of the land, however, it was not in the control of MBPCL to reduce the time extension of around 36 months for such land acquisitions.

4.4 Delay on account of Geological Surprises

4.4.1 The actual geology encountered at the Project site was considerably different from the geology anticipated in the DPR stage. On account of the same, the locations of critical components had to be altered for safe and reliable operations as detailed below:

- **Adit 3:** Portal location had to be shifted as no solid rock was available for the construction of the portal. Decision to shift the portal was taken in March 2011, which required acquisition of adequate land, extension of approach road to the new Adit-3 portal location and development of associated infrastructure. Mitigating the impact of geological surprises accounted for around 8 months of additional time period pushing the project timelines by around 12 months.

- **Surge Shaft:** The change of location of surge shaft due to geological attributes of the area led to the change in the design of penstock from the originally proposed partially surface to completely underground penstock. This led to abandoning of the fully paid originally acquired land (for surface penstock) and acquisition of a suitable plot of land for opening of the vertical shaft along with the land for Valve House and Anchor Block, also the location of Surge Shaft had to be shifted upstream to ensure adequate downstream lateral rock cover. This has further contributed to the delay. The process of land acquisition started in March 2011. The overall acquisition of land, Infrastructure development, open excavation, etc. took nearly 1 (one) year. Thus, there was a time extension of 1.5 years in starting the construction works of Surge Shaft from October, 2010.

- **Section between Adit 1 and Adit 2 (June 2013 to Sept 2014):** On 19.06.2013, the HRT face 5 at Adit -2 Sumin got daylighted by formation of cavity due to less

vertical cover. DMMG (Department of Mine, Minerals and Geology), Government of Sikkim carried out strip survey works. Thereafter, the permission to resume work was granted by East District Collector, vide letter dated 25.09.2014.

4.5 Increase in Construction Time on account of Geological Surprises:

4.5.1 Increase in excavation time

The inferior geology required extensive increase in the scope of construction works namely, change in tunnelling methodology technology. The changes required were as follows:

- Specialised and highly skilled workforce for execution of works
- Elaborate design of adequate tunnel support system
- Because of very fragile geology, having mostly Class-IV and V rock steel rib support besides protection measures such as pipe roofing, fore poling, pre-grouting, poly fibre reinforced Shotcrete and many such protection measures.
- Specialised tunnelling equipment

During actual excavation, the rock classification observed was found to be different than what was originally anticipated. The cycle time for excavating, support and rock stabilization in different Rock Class and providing rock stabilization also increased.

4.5.2 Increase in Concrete Lining Cycle time

Over-break in HRT excavation due to geological conditions - As per DPR, there was a provision of 4% Over-break, however, during excavation of about 3.7 km HRT till 31-Dec-2013, about 26-27% over-break was reported, while for balance works, provision of 8% was considered whereas about 30% over break has been reported while excavating the balance portion because of cavities encountered. The increase in over-break has increased the concrete filling and settling time.

4.5.3 Rectification of Squeezed Area

There has been increase in construction time in rectification works of squeezed portion in various sections of HRT, owing to harsh and extreme bad geology, continues ingress of water pressure, even after providing the approved support system. These rectification works were not envisaged in the approved cost. A cumulative length of 808 m had been squeezed, which required to be rectified.

4.5.4 Excavation and Concrete Lining between Adit 3 and Surge Shaft (Total Length – 1129 m including Abandoned/Sealed excavated Portion)

- As a result of relocation of Adit 3 (explained above), the length of the Adit increased from 319 m to 375 m. On completion of 375 m length, competent rock was not encountered for construction of Junction of ADIT and HRT, hence, the length of the tunnel had to be extended by further 143 m. Thus, the final length of Adit 3 is 518 m. The excavation of Adit 3 portal and construction of junction was completed in May 2013. Further, the rock encountered in the entire length of Adit was Class IV as against Class III which was anticipated, hence, Steel Support and in few sections Fore poling was provided in place of Shotcrete with Rockbolt. In view of the increased length and reduction in average monthly progress from 80 m per month to 30 m per month (increased time cycle due to enhanced rock support), there was an overall increase of 17 months in completion of ADIT 3 excavation works.

- In March 2015, while excavating Face 8, huge continuous slush flow damaged the tunnel and filled it with huge quantity of muck and sludge. Thereafter, efforts were made to stabilize the face by utilizing pipe roofing, fore poling, high pressure pre-grouting with micro-fine cement, and chemical grouting. Despite all the efforts, slush flow could not be stabilized or stopped. Hence, the face was finally sealed and abandoned and the tunnel had to be realigned in March 2017 (Total delay of 19 months)

- After completion of excavation in Dec-2017, tunnel squeezing was encountered because of high pressure on the rock support provide such as Rib protection with ISHB, Pipe Roofing and Fore polling. Due to this, the section was redesigned and the finished dia of HRT over a length of 850 m out of 1129 m has been reduced from 4m to 3.7m. Accordingly, the rectification of the squeezed portion was taken up on only in a cumulative length of 225 m.

- On 12.02.2019, Face 8 at RD 272, HRT was completely blocked due to roof collapse by slush compression of mixture of clay and water and a shear zone was also exposed on the cavity formed on the surface. The cavity was vertically 130 m due to which the section was daylighted. Due to this reason, rectification of cavity in 18 m length was completed, which involved removal of water slush, fore polling and rib erection in 0.5 m spacing and concrete lining work with M-30 Concrete and Microfiber.

- Concrete lining in 279 m long section with finished Diameter of 4 m - After rectification of the day lighted area, the concrete lining work commenced from

August 2019. Concrete lining in 850 m long section with finished Diameter of 3.7 m – After completion of rectification of squeezed section of tunnel with dia less than 4 m and procurement of new 3.7 m Gantry, the concrete lining work commenced from January 2020.

- Due to the above reasons and also the fact that excavation and concrete lining works of the entire section was completed from only one front, it resulted in time overrun.

4.5.5 Vertical Pressure Shaft (VPS) Excavation through Pilot Hole Drilling

- The excavation of VPS started through conventional drill and blast methodology. The average progress was achieved as 6 m in a month. Continuous huge water ingress was encountered in VPS at the depth of 150 m. The dewatering system could not cope up with this enormous quantity of water and water got accumulated. The excavation works could not take place in such condition. In such situation, VPS works was abandoned. MBPCL discussed in detail with designer and consultant on this issue. Designer suggested option to deploy special tools for pilot hole. MBPCL decided for balance excavation by pilot hole methodology. Around 4 cavities of length 22 m, 17m, 12 m and 18m were encountered while excavating 318 m deep VPS. This made it virtually impossible to complete the VPS works without drilling a pilot hole.

- The drilling of pilot hole commenced on 01.09.2016 with customized Drilling machine and due to heavy slush and water ingress the first attempt failed and the drilled hole collapsed. Then another hole was drilled from the right corner of VPS, which also failed. The third attempt was made from the left corner. Thereafter, after making some alterations in the drilling machine, it was tried to drill from the bottom of VPS, which also failed. Finally, another machine was brought and the drilling was conducted from both top and bottom end. Thus, after numerous attempts, the pilot hole having been drilled in 3 stages; 150 mm in Stage 1, 600 mm in Stage 2; and 1000 mm was completed in the month of November, 2017.

- The balance excavation was drilled through 1000 mm dia. drill rod, which successfully drained the accumulated and incoming water from bottom of VPS through LHPS. The excavated muck was removed from the bottom of VPS through LHPS.

4.5.6 **Lower Horizontal Pressure Shaft (LHPS)**

On February, 2016, while excavating the LHPS, a cavity was encountered in LHPS. Huge continuous slush flow damaged the tunnel and filled it with huge quantity of muck and sludge. It took about 4 months to repair the damages and remove the muck and sludge before resuming the excavation works. Excavation work in LHPS and VPS got completed in October 2016 and September 2018, respectively. Thereafter, erection of steel ferrules was started in March 2019 by M/s Texmaco Rail & Engineering Co. Ltd. and was completed in February 2021.

Thus, the total time overrun is approximately more than 4 years while the cost overrun (including escalation) is approximately Rs. 45 Crore cost, including escalation due to time over run.

4.5.7 **Earthquake**

The earthquake measuring frequency 6.9 at the Richter scale had rocked Sikkim in the year 2011 triggering multiple landslides in the Project area, damaging the approach roads, culverts, retaining walls and drains of the Project. Hence, additional time was spent and additional cost had to be incurred in the repair/maintenance of the roads. Additional approach road was constructed for relocation of Adit–I (1.6 km) and Adit-III (500 m).

4.5.8 **Gorkhaland Agitation**

In May 2017, Government of West Bengal announced Bengali as a compulsory subject. Consequently, there were widespread protests and rallies by the residents of Darjeeling resulting in a standstill position. From 09.06.2017, an 'Indefinite Strike' was called by Gorkha Janmukti Morcha (GJM), which was succeeded by another 'Indefinite Strike' called by local ruling party starting from 15.06.2017. The said strikes restricted the entire vehicular movement, access to State and Central Government offices, banks, etc. On account of the aforesaid protests which lasted for ~ 104 days (16.06.2017 to 27.09.2017) and included blockage of West Bengal and Sikkim national highway, transportation and movement of construction materials and machineries was severely impacted.

4.5.9 **Flash flood - washing away of approach road to Power House**

On 01.07.2015, the only motorable access to power house, i.e., the approach road, along with the protection crate wall, retaining wall and breast wall were swept away by flash floods caused by torrential rains. The only other alternative to reach the power house was a kuchha road passing partially through forest land and partially

through private land. With much persuasion, negotiation and support from local administration, on 25.07.2015, an agreement was signed with the landowner allowing passage through his land at a cost. Informal consent was taken from forest officials for plying of vehicles through the forest part of kuccha road. Subsequently, the strengthening of kuchha road took another 10-15 days. Movement of light vehicles (small trucks of construction materials and small components) could commence only by around mid-August 2015. Transportation of heavy components could be resumed around end November 2015, only after restoration of the main approach road.

4.5.10 **Collapse of Rangpo – Rorathang Road**

On 18.07.2019, approx. 100 m stretch of Rangpo - Rorathang road, the only road leading to the Power House site, collapsed in the area below Sikkim Distilleries Limited. The damage was so severe that no space was left even for the pedestrians and a temporary alternative hill track had to be built for pedestrians' use. As restoration of the collapsed portion of the road by Border Roads Organization (BRO) would have taken a long time, the State Government took initiative to build an alternative road with active participation of affected industrial units including MBPCL.

On 26.07.2019, construction of ~ 1 km long alternative road was started. The progress of alternative road construction was closely monitored by the State Government and finally the road was cleared for movement of Light Motor Vehicles and Passenger Vehicles on 29.09.2019. The road was opened for movement of heavy vehicles in the third week of October, 2019. Thus, for over a period of more than 3 months, the transportation of construction materials and equipment remained totally affected in the crucial last stage of the Project, delaying the Project considerably.

4.5.11 **Lockdown on account of COVID-19 Pandemic**

On account of the severity of the threat posed by COVID-19 pandemic, the Government of India on 21.03.2020 imposed a national lockdown, which lasted till 31.05.2020. Due to the said lockdown, all Project activities came to a halt. It was only after the unlock process was started that the Project activities could be re-commenced in a restricted manner till 01.12.2020. Project heads affected due to the lockdown imposed on account of COVID 19 pandemic are mentioned below:

- **Head Race Tunnel Works:** Due to the government-imposed lockdown, the Project activities were completely suspended from 20.03.2020 to 20.06.2020 and from 18.07.2020 till 04.08.2020. Consequently, supply of construction materials, such as cement and steel, was badly affected. Even after relaxation of lockdown

restrictions, arranging and retaining skilled and unskilled manpower was extremely difficult. Therefore, completion of concrete lining works was delayed. Moreover, activities like concrete lining, grouting, invert lining, and Adit plugging of Head Race Tunnel were severely affected due to unusually heavy monsoon that year, which had badly damaged the internal roads leading to Adits. Approach to Adit 2B had to be abandoned.

- **E&M Works:** The erection works of turbine and generator was to be undertaken under presence and supervision of Erection Team of turbine contractor, M/s Listostroj Power, Slovenia and CG Electric Systems Hungary Zrt., Hungary. Owing to COVID 19, visa and permits for travel to India for the erection Team were inordinately delayed. Even after requests to Indian and foreign embassies, the permits for travel to India could not be obtained. Finally, it was decided not to further delay the process by waiting for the arrival of EM Engineers from overseas and to carry on erection works under their remote supervision through video conferencing. MBPCL developed robust infrastructure by arranging high speed internet connectivity and high-resolution cameras for seamless interaction with EM Team. Major erection works of turbine and generator assembly were smoothly and successfully carried out through online guidance and without the physical presence of the Technical Teams from Slovenia and Hungary.

- **Delay in Supply and transportation of Rotor for Unit-2:** Initially, the manufacturing and shipment of Unit-2 Generator Rotor was delayed due to COVID-19 pandemic. Rotor for Unit 2 had sailed from Venice Port on 06.08.2020 and reached Mumbai Port on 21.08.2020. It was then transported through road route and reached Siliguri on 23.09.2020. Unfortunately, thereafter, the National Highway between Siliguri and Sikkim NH-10 near Kali Jhora, got washed away on 20.10.2020 due to heavy landslide. MBPCL made continued requests and follow ups with State PWD for early restoration of road. The road was restored and cleared for heavy traffic only on 25.11.2020. As a result, Rotor of Unit 2 remained stranded in Siliguri for more than a month. The rotor reached project site on 08.12.2020. This led to delay in erection works of Unit-2.

- **Penstock Steel Lining Works:** COVID-19 pandemic adversely affected the manufacturing, supply and erection of penstock by the hydro-mechanical contractor, M/s Texmaco Rail & Engineering Ltd. (TREL). It was anticipated that after lifting up of lockdown restrictions, the penstock works would be completed so as to achieve COD of December 2020. However, there were numerous consequential impacts due to COVID at TREL's workshop slowing down the receipt of raw material, manufacturing works and further timely transport to Project site. This in-turn led to inordinate delays in supply of ferrules, bends and

other specials by TREL. Further, there was work stoppage at the Project site by contract workers engaged by TREL due to non-payment of wages. The situation was, however, salvaged by MBPCL as it made direct payment of wages to the workers. At times, MBPCL also made direct payments to TREL's sub vendors. These direct payments have been subsequently recovered from the bills of TREL. Finally, adequate water availability for trials and full load trial could be expected only around mid to end March/early April, hence, extension of COD to 15.05.2021.

4.6 Additional Information

4.6.1 The 1st Set of Additional Information was sought on the submissions made by on 27.09.2023. MBPCL provided its replies to the queries raised above vide its letters dated 04.11.2023, 08.11.2023, and 01.12.2023. The first Technical Validation Session (TVS) was held on 15.04.2024 with MBPCL to discuss the details provided and 2nd Set of Additional Information required was raised after the first TVS vide letter dated 16.04.2024. MBPCL vide its letters dated 01.05.2024, 03.05.2024, 06.05.2024, 14.05.2024, 15.05.2024 and 29.05.2024 provided its replies to the queries raised.

4.6.2 The 3rd Set of Additional Information requirement was sought vide letter dated 29.05.2024 and the second TVS was held on 03.06.2024 with MBPCL, where certain additional details required were discussed. MBPCL, vide its letter dated 06.06.2024 provided the details to the queries raised vide the 3rd Additional Information requirement and in the second TVS.

4.7 ABPS Analysis and Recommendations

4.7.1 Based on the information, documents and replies to queries submitted by MBPCL and interactions between ABPS Infra and MBPCL, the detailed analysis of Capital Cost has been carried out. Further, MBPCL vide its affidavit dated 15.05.2025 has submitted the details of milestone-wise delay including the scheduled start/end and the actual start/end of each milestone activity and the reason for such delay. The summary of the milestone-wise delay submitted by MBPCL is provided as **Annexure-1**. Hence, based on the details submitted, the issue-wise analysis carried out for the delay is discussed below:

4.8 Land Acquisition

4.8.1 MBPCL has claimed a delay from October 2010 to June 2014 towards land acquisition. Based on the detailed analysis of the information submitted, it has been observed that the land acquisition was delayed for the following reasons:-

- 38 Months (i.e., 31.03.2009 to 16.06.2012) delay in possession of land from land

owners.

- 18 Months (i.e., 01.12.2012 to 01.06.2014) delay due to the change in location and design of the Adit -1 and Adit-2B.

4.8.2 As per the Implementation Agreement, the land required for the Project was to be arranged by the Government of Sikkim and handed over to MBPCL. From the submissions made by MBPCL regarding the delay in land acquisition, it can be observed that MBPCL has made efforts from their end to expedite the land acquisition. However, since the actual acquisition was in the scope of GoS, the delay due to land acquisition was beyond the control of MBPCL. Hence, **delay due to land acquisition may be considered as delay on account of uncontrollable factor and it is suggested to condone the delay on this account.**

4.9 Delay on account of Geological Surprises

4.9.1 The delay of 12 months on account of geological surprises for Adit 3 during FY 2011-12 and delay of 1.5 years from October 2010 for Surge Shaft fall under the delay already considered due to land acquisition as discussed in the section above. Further, the formation of cavity in HRT face at Adit-2 due to less vertical cover, leading to delay from June 2013 to September 2014 is partially considered due to land acquisition till June 2014 and is not an issue that is completely beyond the control of MBPCL and may have been mitigated by better planning and designing by the implementing agency. Further, the exact delay due to such surprises has not been completely justified by MBPCL. Hence, **the delays claimed under this head is suggested not to be condoned.**

4.10 Increase in Construction Time on account of Geological Surprises

4.10.1 MBPCL has claimed a total of 4 years' delay on account of geological surprises due to issues such as increase in excavation time, increased concrete lining cycle, rectification of squeezed area, excavation and concrete lining between Adit 3 and Surge Shaft, Vertical Pressure Shaft Excavation and Lower Horizontal Pressure Shaft cavity. However, it has failed to justify the actual timeline and that the delay was actually due to geological surprises or due to lack of proper planning.

4.10.2 MBPCL has detailed the work performed and the delay in certain instances. However, MBPCL has failed to justify whether such geological surprises could have been mitigated by proper planning and has not provided a detailed timeline for such delay, since certain works may have been taken up in parallelly, while certain works may be performed only when certain works are completed. Therefore, **in the absence of proper justification and clearly defined timelines, it is suggested not to condone the delay on this account.** Earthquake

4.10.3 MBPCL has submitted that an earthquake measuring frequency 6.9 at the Richter scale had rocked Sikkim in 2011 triggering multiple landslides. However, the delay due to earthquake in September 2011 is not quantified in months of delay and falls completely in the window of delay condoned due to land acquisition from March 2009 to June 2012. Hence, **itis suggested tp not condone the delay separately.**.

4.11 Gorkhaland Agitation

4.11.1 MBPCL has submitted that the indefinite strikes in Darjeeling led to blockage of West Bengal and Sikkim national highway, severely affecting transportation, movement of construction materials, machineries and skilled manpower due to the Gorkhaland agitation, i.e., from 16.06.2017 to 27.09.2017. As per Regulation 3.26 of Tariff Regulations, 2015, this qualifies as Force Majeure event. The Regulation is quoted below for ready reference:

> *"3.26. "**Force Majeure**" means any event which is beyond the control of the intra-state user involved which they could not foresee or with reasonable amount of diligence could not have foreseen or which could not be prevented and which substantially affect the performance by either agency such as but not limited to*
>
> *(i) Acts of God, natural phenomena including but not limited to floods, droughts, earthquakes and epidemics*
>
> *(ii) Acts of any Government, domestic or foreign including but not limited to war declared or undeclared, hostilities, priorities, quarantines, embargoes*
>
> *(iii) **Riot or civil commotion***
>
> *(iv) Grid's failure not attributable to agencies involved"*

4.11.2 Considering the above, **the delay may be considered under Force Majeure as it is a sort of civil commotion and hence it is suggested to condone the delay on this account.**

4.12 Flash flood- washing away of approach road to Power House

4.12.1 MBPCL has submitted that on 01.07.2015, the lone motorable access road to the power house was washed away in flash flood and the normalization of the access took till mid-August for light vehicles and till end of November 2015 for heavy

vehicles. As per Regulation 3.26 of Tariff Regulations, 2015, this qualifies as Force Majeure event. The Regulation is quoted below for ready reference:

> *"3.26. "**Force Majeure**" means any event which is beyond the control of the intra-state user involved which they could not foresee or with reasonable amount of diligence could not have foreseen or which could not be prevented and which substantially affect the performance by either agency such as but not limited to*
>
> ***(i) Acts of God, natural phenomena including but not limited to floods, droughts, earthquakes and epidemics***
>
> *(ii) Acts of any Government, domestic or foreign including but not limited to war declared or undeclared, hostilities, priorities, quarantines, embargoes*
>
> *(iii) Riot or civil commotion*
>
> *(iv) Grid's failure not attributable to agencies involved"*

4.12.2 Considering the above, **the delay may be considered under Force Majeure as it may be classified as Acts of God and hence it is suggested to condone the delay of 5 months from 01.07.2015 to 01.12.2015 on this account.**

4.13 Collapse of Rangpo – Rorathang Road

4.13.1 MBPCL has submitted that on 18.07.2019, approx. 100 m stretch of Rangpo - Rorathang road, the only road leading to the Power House site, collapsed in the area below Sikkim Distilleries Limited and the alternative road was open for Light Motor Vehicles and Passenger vehicles on 29.09.2019 and was opened for movement of heavy vehicles in the third week of October, 2019. As per Regulation 3.26 of Tariff Regulations, 2015, this qualifies as Force Majeure event. The Regulation is quoted below for ready reference:

> *"3.26. "**Force Majeure**" means any event which is beyond the control of the intra-state user involved which they could not foresee or with reasonable amount of diligence*

could not have foreseen or which could not be prevented and which substantially affect the performance by either agency such as but not limited to

(i) Acts of God, natural phenomena including but not limited to floods, droughts, earthquakes and epidemics

(ii) Acts of any Government, domestic or foreign including but not limited to war declared or undeclared, hostilities, priorities, quarantines, embargoes

(iii) Riot or civil commotion

(iv) Grid's failure not attributable to agencies involved"

4.13.2 Considering the above, **the delay may be considered under Force Majeure as it may be classified as Acts of God and hence, the delay from 18.07.2019 to 18.10.2015, i.e., 3 months is suggested to be condoned**.

4.14 Lockdown on account of COVID-19 Pandemic

4.14.1 MBPCL has submitted that lockdown imposed on account of COVID-19 pandemic led to delay in various works from March 2020 to December 2020. However, recognizing COVID-19 situation as an extraordinary event, beyond human control and taking note of limitations placed on movement of men and material as per Central/State Govt guidelines leading to impairment of various contractual obligations by parties, Ministry of Finance, GoI issued Office Memorandum dated 13.05.2020 vide which COVID-19 situation was treated as a Force Majeure event and extension in completion of works from three to six months was allowed without imposition of any cost or penalty. The relevant extract is provided below:

"Attention is invited to Department of Expenditure's O.M. No. 18/4/2020-PPD dated 19th February, 2020 on the invocation of Force Majeure Clause (FMC). Vide the O.M., it was clarified that disruption of supply chains due to the spread of Coronavirus will be covered under FMC which could be invoked, wherever considered appropriate, following the due procedure as stated in para 9.7.7 of the Manual on Procurement of Goods.

2. Subsequent to issuance of the above referred O.M., further disruptions have affected the transportation, manufacturing and distribution of goods and services in the country. Limitations placed on the movement of men and materials as per the guidelines issued by the Ministry of Home Affairs (MHA) under the Disaster Management Act, 2005 (DM Act 2005) and the respective State and UT governments from time to time have severely impacted the fulfilment of contractual obligations for

supply of goods, works and consultancy services (including other services), and affected the volume of vehicular traffic.

3. Attention in this regard is invited to para 9.7.7 of the "Manual for Procurement of Goods 2017", Para 6.4.2 of the "Manual for Procurement of Works 2019" and para 8.14.1 of the "Manual for Procurement of Consultancy and other Services 2017" issued by the Department of Expenditure. The above referred three Manuals recognize extraordinary events or circumstances beyond human control leading to delays in or non-fulfilment of contractual obligations. In a situation of such events happening, and after following due procedure, parties to the contract are allowed flexibility to invoke FMC following prescribed due procedure.

4. It is recognised that in view of the restrictions placed on the movement of goods, services and manpower on account of the lockdown situation prevailing overseas and in the country in terms of the guidelines issued by the MHA under the DM Act 2005 and the respective State and UT Governments, it may not be possible for the parties to the contract to fulfil contractual obligations. In respect of Public-private Partnership (PPP) concession contracts, a period of the contract may have become unremunerative. Therefore, after fulfilling due procedure and wherever applicable, parties to the contract may invoke FMC for all construction/works contracts, goods and services contracts and PPP contracts with Government Agencies and in such event, date for completion of contractual obligations which had to be completed on or after 20th February 2020 shall stand extended for a period not less than three months and not more than six months without imposition of any cost or penalty on the contractor/concessionaire. Concession period in PPP contracts ending on or after 20th February 2020 shall be extended by not less than three and not more than six months. The period of extension (between three and six months) may be decided based on the specific circumstances of the case and the period for which performance was affected by the force majeure events."

4.14.2 Hence, **the delay from 24.03.2020 to 23.09.2020, i.e., 6 months is suggested to be condoned as delay due to COVID-19, instead of 9 months claimed by MBPCL**.

4.14.3 **Head Race Tunnel Works**

MBPCL has submitted that approach to Adit 2B had to be abandoned due to COVID-19 lockdown restrictions from March 2020 to August 2020 affecting supply of construction materials and man power availability and heavy monsoon in 2020. However, since the delay from March 2020 to September 2020 is already dealt with in the section above and since, MBPCL has not been able to justify the exact delay

period along with the details of the rainfall, **the delay claimed under this head is suggested not to be condoned.**

4.14.4 **E&M Works**

MBPCL has submitted that E&M Works of turbine and generator was affected due to non-availability of supervision from Erection Team of turbine contractor, M/s Listostroj Power, Slovenia and CG Electric Systems Hungary Zrt., Hungary due to COVID-19. However, MBPCL has submitted that it was later carried out with online guidance and without the physical presence of the Technical Teams from Slovenia and Hungary. It is observed that MBPCL has failed to substantiate the exact delay due to this specific issue and since the delay of 6 months from March 2020 to September 2020 is already dealt with in the section on COVID-19, **any further delay need not be considered**.

4.14.5 **Delay in Supply and transportation of Rotor for Unit -2**

MBPCL has submitted that manufacturing and shipment of Unit-2 Generator Rotor was delayed due to COVID-19 pandemic and supply was further delayed due to landslide on National Highway between Siliguri and Sikkim NH-10 till 25.11.2020. However, it is observed that the Rotor for Unit 2 had sailed from Venice Port on 06.08.2020 and reached Mumbai Port on 21.08.2020 and then reached Siliguri by 23.09.2020. Since, the delay till 23.09.2020 is already condoned and the landslide happened on 20.10.2020, one month after the rotor arrived at Siliguri, the delay in supply of the rotor **is suggested not to be condoned as there is a delay of one month between the arrival of the same in Siliguri and the occurrence of landslide**.

4.14.6 **Penstock Steel Lining Works**

MBPCL has submitted that manufacturing, supply and erection of penstock by the hydro-mechanical contractor, M/s Texmaco Rail & Engineering Ltd., led to delay beyond December 2020. However, there were numerous consequential impacts due to COVID at TREL's workshop slowing down the receipt of raw material, manufacturing works and further timely transport to Project site. This in-turn led to inordinate delays in supply of ferrules, bends and other specials by TREL. Further, there was work stoppage at the Project site by contract workers engaged by TREL due to non-payment of wages. It is observed that the delay claimed under COVID-19 is already dealt with till September 2020 and the additional delay due to payment issues are to be taken care of by the contract between Texmaco and MBPCL. MBPCL further submitted the project was also delayed due to non-availability of water and delay in full load trial. However, MBPCL has not provided a detailed submission on the same. Hence, **the delay on this account is suggested not to be condoned**.

4.15 Total Delay to be Condoned

4.15.1 In view of the above observation and analysis, out of total delay of 111 Months claimed by MBPCL, it is suggested that the delay of 73 Months can be condoned as shown below:

Table 5: Summary of Delay to be Condoned

Sr. No.	Particulars	Start Date	End Date	Delay Condoned (Months)
1)	Land Acquisition *(Delay due to possession of land from land owners)*	31-03-2009	16-06-2012	38
2)	Land Acquisition *(Delay due to change in location and design of the Adit -1 and Adit-2B.)*	01-12-2012	01-06-2014	18
3)	Gorkhaland Agitation	16-06-2017	27-09-2017	3
4)	Flash Flood	01-07-2015	01-12-2015	5
5)	Collapse of Rangpo – Rorathang Road	18-07-2019	18-10-2019	3
6)	Covid-19 Pandemic	24-03-2020	24-09-2020	6
	Total delay condoned			**73**
	Total delay Claimed by MBPCL			**111**
	Total delay condoned % of Total delay Claimed (9=(7/8)*100)			**65.77%**

5 Cost Overrun

5.1 Major factors leading to increase in the Capital Cost

5.1.1 During implementation of the Project, change in capacity, design, quantum of work and time overrun resulted in increase of capital cost by 227% from Rs. 492.32 Crore to Rs. 1612.30 Crore for installed capacity of 113 MW.

5.1.2 The major factors leading to increase in the capital cost of the project are as follows:-

a) Barrage Works, Conveyance and Power House works
b) E&M Works Including Transmission Lines
c) Preliminary Expenses
d) Land Acquisition
e) Miscellaneous
f) Communication (Other Infrastructure)
g) Environment & Ecology
h) Establishment Expenses
i) Interest During Construction (IDC)

5.1.3 Considering the major factors discussed above, the DPR was initially drafted for a capacity of 96 MW plant at the estimated cost of Rs. 492.32 Crore. The break-up of the cost estimated in the DPR is as below:

Table 6: Summary of Capital Cost as per the Initial DPR

Description	Original Estimated Cost in DPR (Rs. Crore)
CIVIL WORKS	
I – Works	
A – Preliminary	10.00
B – Land	10.00
C - WORKS	35.71
J - WORKS - CONVEYANCE & POWERHOUSE	155.15
K - BUILDINGS	7.51
M - PLANTATION	0.60
O - MISCELLANEOUS	5.40
Q - SPECIAL TOOLS AND PLANT	3.22
R – COMMUNICATION (OTHER INFRASTRUCTURE)	12.77
X - ENVIRONMENT AND ECOLOGY	5.00
Y. Losses on stock @ 0.1% of (I-Works less A, B, M, O, Q, X and P)	0.21
Total I- WORKS	**245.58**
II - Establishment @ 8% (of cost of I works less)	19.65

Description	Original Estimated Cost in DPR (Rs. Crore)
III - Tools and Plants @ 1% Cost of I Works	2.46
Total Civil Cost	**267.69**
E&M Works excluding Transmission Lines	112.1
Transmission Lines	20.06
Total Construction Cost	**399.85**
Escalation Cost	46.77
Total Project Cost Before IDC	**446.61**
Interest During Construction	45.71
Total Cost Including Escalation & IDC	**492.32**

5.1.4 The Major works under the heads "Works" (Barrage Works), "Works- Conveyance & Powerhouse" (Conveyance and Power House Works), "E&M Works excluding Transmission Lines" and "Transmission Lines" were awarded based on Competitive Bidding. The Major Packages awarded and the value for which the works are awarded are summarized below:

Table 7: Summary of Packages Awarded through Competitive Bidding

Sr. No.	Name of Contractor	Scope of work	Package	Mode of award	Value of Award of Work without Taxes (Rs. Crore)
Work Under Civil					
1	SEW Infrastructure Limited	Civil Works for Barrage, Intake and Desilting Basin.	I	ICB	27.52
2	Moshvaraya Infrastructure Ltd	Civil Works for Barrage, Intake and Desilting Basin.		Contract was awarded for balance quantity with same terms and conditions	24.17
3	Aimil Limited	Barrage Instruments			0.21
4	SEW Infrastructure Limited	Head Race tunnel including its Adits, Surge Shaft, UHPS, VPS & LHPS.	II	ICB	104.28
5	Moshvaraya Infrastructure Limited	Head Race tunnel including its Adits, Surge Shaft, UHPS, VPS & LHPS.		Contract was awarded for balance quantity with same terms and conditions	111.03
6	SEW Infrastructure Limited	Power House , TRC & Switchyard	III	ICB	25.53
7	Moshvaraya Infrastructure Limited /Everest Industries Ltd	Power House complex, Switchyard and Valve House, Tail Race Channel		Contract was awarded for balance quantity with same terms and conditions	15.37
8	Texmaco Rail and Engg. Limited	Procurement, Manufacture/fabrication, supply & services of the Penstock Steel (Part of Conveyance and Power House cost)	V	ICB	46.00
9	Chhattisgarh Metallks and Alloys Pvt. Ltd.	H & M (For Design, Procurement, Manufacture/fabrication, supply & services of the Barrage gate Hydro-Mechanical works) (Part of Barrage cost)		Contract was awarded after foreclosure of contract with Aarti	12.79
Work Under Electromechanical(E&M)					
10	Litostroj Power d.o.o.	Turbine & Auxiliaries, Cooling & Drainage water System, HPU & Governor (Supply and Service)	IV	Contract was awarded after abandonment of contract with Voith	33.96

Sr. No.	Name of Contractor	Scope of work	Package	Mode of award	Value of Award of Work without Taxes (Rs. Crore)
11	M/s CG Electric Systems Hungary Zrt	Generator & Auxiliaries (Supply and Service)	IV	Contract was awarded after abandonment of contract with Voith	42.29
12	Voith Hydro Pvt Ltd	Contract for Work of Design, Engineering, Manufacturing, Supply, Inspection, testing at works of Electro Mechanical Equipment's (Supply and Service)	IV	ICB	101 Crore including Service Contract
13	SANELEC EXCITATION SYSTEMS PVT LTD	Digital Static Excitation System & Mandatory Spares	IV		3.01
		Supply of Advantech HMI with related Accessories & Cable	IV		0.06
		220KV DC Tripping Coil, for DC field Breaker & Handling Charges	IV		0.01
14	Powersol Engineers & Consultants Pvt Ltd	Design, Procurement, Fabrication/Manufacture and Supply of 1650mm Main Inlet Valve (PN50) and its accessories with spares & Proximity Sensor Connectors	IV		5.72
					7.00
15	PROLEC GE India (Indo Tech Transformers Limited)	Supply of 60/75 Generator Transformer Spare Bushing and Supply of 10 MVA Transformer Spare Bushing	IV		0.13
16	Indo Tech Transformers Limited	Deputation of Service Engineer for Supervision of Erection, Testing & Commissioning of 2nos 75 MVA and 1 Nos 10 MVA Transformer extra 5-man days service required. 10000*5 days	IV		0.01
17	Unique Industrial Handlers Pvt Ltd	EOT CRANE	IV		1.31
Works Under Power Evacuation System					
18	Powersol Engineer and Consultant P. Ltd. (TL)	Transmission Line	V	ICB	14.55
19	Hyosung T & D India Pvt. Ltd. (Supply)	GIS Bays	V		11.54
20	NLM Infra Projects	GIS Bays Building Extension			0.32

Sr. No.	Name of Contractor	Scope of work	Package	Mode of award	Value of Award of Work without Taxes (Rs. Crore)
21	NLM Infra Projects	Pooling Sub Station Switchyard			0.50
22	Dinesh Acharya And Others	Tower Protection Work and Others			0.22
Total					**588.53**

5.1.5 From the above, it can be observed that the Packages I, II & III, initially awarded to M/s. SEW Infrastructure Limited were later foreclosed and terminated. The Packages were later awarded to M/s. Mosh Varaya Infrastructure Private Limited, including the Change in Scope of Work. Similarly, the Hydro & Mechanical Works (except Penstock and Steel Liner) was initially awarded to M/s. Aarti Infra Projects Private Limited, which was later awarded to M/s. Chhattisgarh Metallks and Alloys Private Limited as it was foreclosed and terminated. Further, the Electromechanical works of the Project was initially awarded to M/s. Voith Hydro Private Limited, which was abandoned and later awarded to M/s. CG Electric Systems Hungary Zrt.

5.1.6 MBPCL has submitted the completion cost of the Project as summarized below:

Table 8: Summary of Final Capital Cost as on COD of the Project

Description	Completion Cost (Rs. Crore)
CIVIL WORKS	
I - Works	
A - Preliminary	20.50
B - Land	25.62
C - WORKS	109.05
J - WORKS - CONVEYANCE & POWERHOUSE	514.52
K - BUILDINGS	2.52
M - PLANTATION	0.63
O - MISCELLANEOUS	10.59
Q - SPECIAL TOOLS AND PLANT	1.90
R – COMMUNICATION (OTHER INFRASTRUCTURE)	43.78
X - ENVIRONMENT AND ECOLOGY	6.50
Y. Losses on stock @ 0.1% of (I-Works less A, B, M, O, Q, X and P)	0.00
Total I- WORKS	**735.61**
II - Establishment @ 8% (of cost of I works less)	71.48
III - Tools and Plants @ 1% Cost of I Works	1.52
Total Civil Cost	**808.61**
E&M Works excluding Transmission Lines	153.12
Transmission Lines	35.91
Total Construction Cost	**997.64**
Escalation Cost	84.99
Total Project Cost Before IDC	**1082.63**
Interest During Construction	529.68
Total Cost Including Escalation & IDC	**1612.31**

5.1.7 Hence, in order to better analyse the variation between the DPR Estimated Cost, Award Cost based on the Bidding, and Completion Cost, a comparative study has been undertaken based on the details submitted by MBPCL against the queries raised

against various aspects of the Capital Cost. The "Barrage Works, Conveyance and Power House Works" and "E&M Works Including Transmission Lines", which contribute to nearly 75% of the overall completion cost of the Project are analysed in detail considering the DPR Estimate, Award Cost, and the Completion Cost. Further, the other components of the Project Cost are also analysed in detail with respect to the DPR estimate in the following sections.

5.2 Barrage Works, Conveyance and Power House Works

Barrage Works

5.2.1 MBPCL submitted that as against the original estimate of Rs. 35.71 Crore, the final completion cost as on COD under this head is Rs. 109.05 Crore.

Table 9: Increase in Cost of Barrage Works

Description	Original Approved Estimated Cost (Rs. Crore)	Final Audited Cost incurred (Rs. Crore)	Difference (Rs. Crore)	% Variation
Works	35.71	109.05	73.34	205.38%

5.2.2 MBPCL further submitted the following reasons for the substantial increase in the cost of Civil Works for Barrage:

a) **Excavation, Foundation Treatment & Concreting cost:** During the execution of the project, the length and cross-sectional area of barrage had to be increased, resulting in more excavation and higher volume of concreting. At the new location, the foundation had to be taken to the greater depth due to soil conditions.

b) **Increase in Excavation Quantity:** The excavation quantity increased in barrage complex due to additional slope stabilization works for rim treatment at upstream of barrage and in right bank embankment slope owing to fragile rock. This excavation quantity was not estimated initially. The overall excavation quantity was ~182630.90 cum till November, 2020 when the excavation works were completed.

c) **Increase in Reinforcement & Concrete Quantity:** The quantity of concreting and reinforcement increased in barrage complex works mainly due to change in design of slope stabilization works. While the initial consideration was made for RR masonry works, however, based on the revised design considerations, RCC reinforcement with M25 grade with ~additional 16000 cubic meter (as against

initial estimates of ~70000 cubic meters) concreting had to be considered keeping in view the recent guidelines and stipulations of relevant BIS codes. The additional concreting works were executed in upstream guide wall, barrage approach road slab in deck and concreting in silt flushing pipe at downstream of Desilting bank. The plumb concreting was also not considered in earlier estimates, which was executed besides the cut-off wall and Desilting basin.

d) **Hydro-mechanical Cost:** Due to increased length and cross-sectional area of barrage, the cost increased due to greater width of gates, capacity of hoist and its accessories.

e) **Increase in Tax Rates**: The cost increased due to change in tax rate on works and materials. Earlier, the applicable Service Tax rate was in the range of 4% to 6% in works contracts. Currently, after the introduction of GST, the applicable tax rate is flat 18%.

5.2.3 In response to the clarification sought regarding the increase in barrage work expenses, MBPCL submitted that the cost increase for the following reasons:-

a) The DPR for the 96 MW Rongnichu HPP was prepared in 2006. The unit rates in the bill of quantities were considered based on the base year of February 2006. The total estimated cost for structures under this head, including the barrage and intake, desilting chamber, and feeder tunnel, was Rs. 35.71 Crore.

b) The civil works were awarded in 2010 through International Competitive Bidding (ICB) norms. The item rates were inclusive of taxes, and the bill of quantities (BOQ) rates were awarded with provisions for escalation (increase/decrease).

c) During the detailed design and engineering phase, the designs of the barrage and intake, as well as the desilting chamber, were modified due to factors such as non-availability of land, structural stability, rock foundation conditions, and ease of construction activities. Additional work not included in the original DPR was carried out under this head, such as the construction of an approach road for components and rim treatment on the right and left banks. Rim treatment was essential to protect the banks by resisting capillary action during sudden drops in the barrage water level.

d) The dimensions of the barrage, intake, and desilting basin as finalized in the detailed design and engineering phase differed from those specified in the DPR. The changes in dimensions are detailed below:

Table 10: Barrage Works dimension change

Sr. No	Description	Unit	DPR	As per Construction Drawing
1	**Barrage Structure**			
1.1	Full Reservoir Level	m	740.00	740.00
1.2	Crest Level	m	728.00	728.00
1.3	Crest length	m	8	9.4
1.4	Crest width	m	27.5	28
1.5	Dissipator basin length	m	47	59
1.6	Dissipator basin width	m	27.50	28
1.7	Deepest foundation level	m	719.00	710.50
2	**Intake Structure**			
2.1	Intake Invert Level	m	731.00	725.70
2.2	Number of entries	No	3.00	1.00
2.3	Gate Size	m*m	4*3.5	4*4
3	**Desilting Basin**		Under Ground	Surface
3.1	Number of Basins	no	1.00	2.0
3.2	Length of Basin	m	161.00	59.00
3.3	Width of Basin	m	12.00	35.90
3.4	Height of Basin	m	15.00	9.50

5.2.4 Further, reasons for change in quantity and cost for barrage and intake, desilting basin, Feeder Tunnel, Hydro Mechanical works for barrage, intake and desilting basin, rim treatment, approach road, miscellaneous works and tax rates are as follows:-

i) Barrage and Intake

a) Due to the non-availability of land, the barrage axis was shifted 20 meters upstream from the DPR axis, resulting in an increase in excavation quantities for the foundation and the right bank abutment.

b) During detailed design and engineering, the dimensions of the barrage were increased, leading to higher excavation quantities. Additionally, the presence of fragile rock necessitated deeper excavation, further increasing the excavation quantity.

c) Plumb concreting work was executed in the cutoff wall of the barrage.

d) The quantities of concrete and reinforcement work increased mainly due to changes in design, the grade of cement, and the requirements for the foundation and protection walls of the barrage, intake, and desilting basin.

The cost for the barrage and intake increased from Rs. 12.28 Crore in the original DPR to Rs. 48.94 Crore in actual execution, resulting in an increase of Rs. 36.66 Crore.

ii) Desilting Basin

a) In the DPR, the desilting basin was proposed to be underground. However, during detailed design and engineering, it was determined that the underground proposal was not effective for silt removal and had a higher risk of frequent clogging in the silt flushing system. Additionally, the excavation quantity and cost for the underground desilting basin were higher compared to a surface-type desilting basin. Consequently, a surface-type desilting basin was adopted instead.

b) The quantity of concrete and reinforcement work increased due to the enlarged dimensions of the desilting basin.

c) Additional concreting was executed for the upstream guide wall to protect the desilting basin and improve the silt flushing arrangement.

d) Plumb concreting work was executed in the cutoff wall of the desilting basin.

The cost for the desilting basin increased from Rs. 11.02 Crore in the original DPR to Rs. 27.57 Crore in actual execution, resulting in an increase of Rs. 16.55 Crore.

iii) Feeder Tunnel: The cost for the feeder tunnel decreased from Rs. 4.88 Crore in the original DPR to Nil in actual execution.

iv) Hydro Mechanical works for barrage, intake and desilting basin

a) The increase in the size of the stop log gate.

b) The increase in the size of the spillway and under-sluice gate.

c) In the DPR, the desilting basin was proposed to be underground with two outlet gates and a silt flushing arrangement. However, during the detailed design and engineering phase, a surface-type desilting basin was constructed. For the surface-type desilting basin, the cost increased due to the need for

additional stop log gates, inlet gates, rope drum hoists, and a monorail for lifting the stop log gate.

d) Spare parts were not considered in the DPR quantities.

e) The cost of instruments and the control system for the barrage was not included in the DPR. In the detailed design and engineering phase, this cost was considered, amounting to Rs. 62.50 Lakh.

The cost for the Hydro Mechanical works for barrage, intake and desilting basin increased from Rs. 7.53 Crore in the original DPR to Rs. 13.85 Crore in actual execution, resulting in an increase of Rs. 6.31 Crore.

v) Rim treatment

a) Excavation was carried out on the right and left banks for rim treatment, which was not estimated in the DPR quantity.

b) Concreting works were executed to create rim treatments on the right and left banks of the barrage to resist or avoid capillary action or forces caused by a sudden drop in water level in the barrage.

c) Reinforcement works were carried out for the rim treatment on both banks.

The cost for the rim treatment was considered nil in the original DPR, whereas during actual execution, rim treatment was required, resulting in additional cost of Rs. 7.49 Crore.

vi) Approach road: The cost for the approach road in the original DPR was nil whereas at time of actual execution the approach road was constructed at Rs. 0.45 Crore for barrage works.

vii) Miscellaneous works: The cost under miscellaneous work increased due to changes in the dimensions and design of components. This led to a higher execution of activities such as shotcreting, compaction, grouting, anchoring, dewatering, and the installation of PVC water stoppers compared to the quantities estimated in the DPR.

viii) Tax rates: In the DPR, unit rates were based on the prices from February 2006, a period during which service tax was not applicable. Consequently, the increase in

cost due to taxes is Rs. 808.38 Lakh for civil work and Rs. 205.80 Lakh for hydro-mechanical work.

5.2.5 It is observed that contract agreements allow alteration, addition and omission in the civil works. The relevant clause is reproduced below:

> *" **Variations***
>
> *The Engineer-in-charge shall have powers to make any variation of the form, quality or quantity of the works or any part thereof that may in his opinion necessary and for that purpose, if for any other reason it shall in his opinion be desirable, he shall have power to order the contractor to do and the Contractor shall do any of the following:-*
>
> *a) Increase or decrease the quantity of any work included in the Contract.*
> *b) Mit or substitute any such work,*
> *c) Change the character or quality or kind of any such work.*
> *d) Change the levels, lines, position and dimensions of any part of the works.*
> *e) Execute additional work of any kind necessary for the completion of the works and no such variations shall in any way vitiate or invalidate the Contract, but the value, if any or all such variations shall be taken into account in ascertaining the amount of the contract price, and*
> *f) Change any specified sequence, method or timing of construction of any part of the work."*

5.2.6 It is observed that the cost increase in barrage work expenses is a result of several uncontrollable parameters. Major reason for increase in cost is due to extensive modifications and unforeseen circumstances encountered during the detailed design and engineering phases. Changes in structural designs, land availability, and excavation requirements, along with the necessary adjustments for stability and functionality, significantly impacted the project's financials. The shift in the barrage axis, deeper excavation due to fragile rock conditions, and the transition from an underground to a surface-type desilting basin are prime examples of such factors. Further, increases in tax rates and the need for additional components not initially considered, such as rim treatments and hydro-mechanical instruments, further contributed to the cost escalation. Moreover, the contract provisions allowing for alterations, additions, and omissions in the civil works underscore the necessity and legitimacy of these variations. Hence, the increase in costs from Rs. 35.71 Crore to the actual Rs. 109.05 Crore, reflecting a rise of Rs. 73.34 Crore for the barrage works. The increase of barrage works as submitted by the Petitioner is summarized as below:-

Table 11: Increase in Cost of Barrage Work

Particulars	Original Approved Estimated Cost (Rs. Crore)	Final Audited Cost incurred (Rs. Crore)	Increase Cost (Rs. Crore)
Barrage and intake	12.28	48.94	36.66
Desilting basin	11.02	27.57	16.55
Feeder Tunnel	4.88	0.00	(4.88)
Hydro Mechanical works for barrage, intake and desilting basin	7.53	13.85	6.31
Rim treatment	0.00	7.49	7.49
Approach road	0.00	0.45	0.45
Taxes and Duties of Civil Works	0.00	8.08	8.08
Taxes and Duties of HM Works	0.00	2.05	2.05
Barrage Instrument & Man Power Supply	0.00	0.27	0.27
Total	**35.71**	**108.71**	**73.02***

** Note: There is a variation of Rs. 0.32 Crore between the actual increase and the summary submitted. However, since the details are submitted for the major portion of the increase claimed and considering that the total project cost is certified by the Auditor, the increase of Rs. 73.34 Crore is considered*

Based on details submitted, it is observed that significant changes in the barrage design were made due to unforeseen conditions at the time of project execution, which could not have been envisioned at the project planning phase. Further, these changes are approved by GoS through TEC and MBPCL has also provided the Lender's Engineer's Report by M/s. Energy Infratech Pvt. Ltd., in which these changes have been approved. As discussed earlier, the contracts provide for the variation in the scope of works with revision in price. The actual expenses incurred till the COD are substantiated by the Auditor's Certificate. Hence, it is suggested to allow **the claimed increase in cost of Rs. 73.34 Crore by MBPCL for barrage works.**

Conveyance and Power House Works

5.2.7 MBPCL has claimed increase in cost of Conveyance and Power House Works due to the following reasons:

a) **Geology:** In the DPR and during the survey and engineering stage, the geology envisaged was approximately 21.10% Class-II, 62.28 % Class-III and 16.62 % Class IV rock. However, the geology encountered was 40% Class-III and 60% Class-IV rock. Increase in the percentage of Class-IV rock increased the cost of the support system required for rock stabilization, viz. rib installation, pipe roofing, rock bolt, wire mesh fixing, Shotcrete, etc. Moreover, due to poor geology, the location of Adit-3 and Surge shaft had to be shifted and the design of the pressure shaft (Vertical pressure shaft and Lower Horizontal Penstock pressure shaft) had to be changed. This has contributed to the increase in cost of the Project.

b) **Increase in the number and Size of Adits:** A total of three Adits were planned at DPR stage but as the work started; Adit-0 was introduced to expedite the excavation works of HRT and to avoid accidents due to sudden ingress of water surging into the tunnel from intake during excavation process (as in case of Chuzachen HEP of Gati Infrastructure Private Limited). Further, the size of Adits was increased to 6 m x 5.5 m from 5 m x 5.5 m, as planned in the DPR, to facilitate

easy movement of vehicles inside the Adit from both the faces of HRT to expedite the mucking operation.

c) **Increase in the sectional area (Cross Section) of HRT:** Originally 4 to 4.5 m diameter horse shoe shaped tunnel was proposed for excavation of HRT. However, considering the increase in capacity of the station, i.e., the size of the machines to be deployed, the shape of tunnel was changed to D-shape, with an opening of 4.5 m. This led to an increase in the cross-sectional area of excavation, having a net effect in increasing the quantities of excavation, concrete lining and the primary support system. The design of steel support system was also changed and reduced the rib spacing. The mild steel plate of 3 mm has been used instead of RCC precast legging. The overall cost on account of the above has been around 3 times the initial estimates made in the DPR. To ensure the safe operations of the station, pipe roofing and fore polling has also been executed at various faces of HRT which has increased the cost. The executed quantity of pipe roofing was in excess of 2,50,000 m as against the initially estimated quantity of 68,000 m.

d) **Change in Finished Dia of HRT in section between Adit 3 and Surge Shaft:** After completion of excavation, tunnel squeezing was encountered because of high rock on the support provide such as Rib protection with ISHB, Pipe Roofing and Fore polling. Chemical grouting of cumulative 19 m portion was done in order to stabilize the tunnel. However, the chemical grout proved ineffective to strengthen the rock, thus, in order to stabilize the tunnel in this section, in-stability and anticipated damage, this section was re-designed keeping the diameter 3.7 m to reduce the in-situ stresses and also the stress changes that are induced when tunnels are excavated in this highly un-stabilised stressed rock.

e) **Increase in Length of HRT:** On 19.06.2013, the HRT face 5 at Adit-2 Sumin got day lighted by formation of cavity due to less vertical cover. DMMG (Department of Mine, Minerals and Geology), Government of Sikkim carried out strip survey works. The tunnel was sealed and abandoned and the tunnel had to be realigned. As a result of the above incident, the total length of HRT increased to 12.58 km as against the original length of 12.302 km. The alignment of HRT in between face 8 and 9 was changed during the course of Project development. On account of shear and fault zone encountered in the Project, which resulted in continuous ingress of water and mud, the alignment of HRT had to be shifted, which resulted in increase in HRT length by 14.51 m and an excavated length of 40.11 m was abandoned, hence a total of 54.62 m of HRT length was increased.

f) **Rectification of the caved section between Adit 3 and Surge Shaft:** Shear and fault zone was encountered amidst section between Adit 3 and Surge Shaft, which

created 2 to 2.5 m cavity at RD 773 to 791 from Surge Shaft. This led to water flow and mud in the form of slush, which was deposited in the HRT. Due to this reason, additional work of excavation, fore poling, rib erection in 0.5 m spacing and concrete lining work was involved for removal of water slush and rectification of cavity in 18 m length.

g) **Increase in backfill quantity:** The increase in HRT length, cavity formation and over break resulted in increase in the backfill quantity. On account of the factors detailed above, the overall backfill quantity exceeded by around 30% as compared to the initial estimates of 56288 cubic meters. Main reason for cost increase under this head was due to over-break quantity, which consequently increased the backfill quantity.

h) Increase in Quantum of De-Watering

i) **Change of grade of Mix design:** Due to back pressure and extreme bad geology and the excavated tunnel being squeezed in various sections even after providing the approved support system in between face 8 and 9, the concrete lining works were changed from M30 grade to M20 with SFRS in 1,128 m.

j) **Adoption of Pre-grouting methodology with Micro Fine Cement:** The geology of the Tunnel was different from the geology anticipated during the DPR stage. In order to strengthen the rock mass and control water ingress in very weak patches, it was mandatory to adopt high pressure pre-grouting with micro-fine cement. Accordingly, pre-grouting with micro fine cement was done at various locations to avoid cavity formation and collapse of tunnel. The cost of pre-grouting was not included in the original DPR.

k) **Increase in grouting:** Poor geology led to increased grouting in HRT. In the revised cost estimate, the grouting was estimated as 70,963 bags, whereas in the executed Project, quantity increased to 1,09,116 bags.

l) **Slope Protection along Valve House:** Due to landslide that occurred on 23rd Sep 2020, the backside slope got damaged behind the valve house area. The preventive slope protection works in terms of shotcrete, etc., done earlier also got damaged. To stabilize the backside slope and valve house area, slope protection works in the form of reinforced concrete wall as suggested by the project designer was carried out.

m) **Increase in reinforcement concrete in Bend:** As per the detailed drawing, all bends were underground and covered with PCC M20 concreting. However, due to change in excavation methodology as per site conditions, B1 bend has been

provided on surface. Accordingly, the design has been changed by the designer with provision of RCC concreting of M25.

n) **Increase in quantity of acceptable over breaks:** Due to the inferior class of rock actually encountered than the class envisaged in the DPR, the cost of over break has also increased. While the over breaks envisaged in DPR were around 8%, the Project encountered over breaks as high as 30%. This has also added to the quantity of backfill concrete and concrete lining, thereby increasing the cost. Considering the above reasons, the rate of excavation of HRT was barely around 60 m per month per face of HRT except for face 6 and face-7 for which the rate was around 70 m per month per face. In comparison to the above, at the DPR stage, the rate of progress of HRT was assumed to be 80 m per month per face.

o) **Change in the design of Pressure shaft (Vertical Pressure shaft and Horizontal Pressure shaft):** Though revised design ensured safety and stability of penstock, the execution of underground work [both excavation and thereafter erection of steel ferrules] proved to be very difficult, time consuming and also costlier.

p) **Change in methodology of Excavation of Vertical Pressure shaft:** On reaching the depth of 150 m, cavities and continuous water ingress were encountered. The enormous quantity of water accumulation made further excavation impossible. For further exaction, a custom built specially designed drilling / boring machine was deployed. Drilling was carried out from both the top and bottom of VPS. After numerous attempts, the pilot hole was drilled in 3 stages; 150 mm in Stage 1, 600 mm in Stage 2; and 1000 mm in Stage 3, was completed in the month of November, 2017.

q) **Increase in tax rates:** Due to implementation of GST, the tax rate on works contracts increased to 18% against the earlier applicable rates, in the range of 4% to 6%.

5.2.8 The increase claimed is summarized below:

Table 12: Increase in Cost of Conveyance and Power House Works

Description	Original Approved Estimated Cost (Rs. Crore)	Final Audited Cost incurred (Rs. Crore)	Difference (Rs. Crore)	% Variation
Conveyance and Power House Works	155.15	514.52	359.37	231.63%

5.2.9 In response to the clarification sought regarding the increase in Conveyance and Power House Works expenses, MBPCL submitted the following reasons:-

a) The DPR for the 96 MW Rongnichu HPP was prepared in 2006. The unit rates in the bill of quantities were based on the prices from February 2006. The total cost for structures under this head, including the Head Race Tunnel (HRT), Surge Shaft, Penstock (Vertical Pressure Shaft and Lower Horizontal Pressure Shaft), and Powerhouse, was estimated in the DPR to be Rs. 155.15 Crore.

b) The civil works were awarded in 2010 through International Competitive Bidding (ICB) norms. The item rates were exclusive of taxes, and the BOQ rates were awarded with provisions for escalation (increase/decrease).

c) During the detailed design and engineering phase, the dimensions and design of components changed due to rock foundation conditions, vertical and lateral cover requirements, cross-sectional area adjustments, and construction considerations for ease of construction activities. In the DPR proposal, a 3.0-m diameter penstock was to be surface type. However, during detailed design and engineering, it was changed to an underground penstock due to the surface route lying in a sinking zone. Thus, the entire penstock went underground for safety and stability.

d) In the DPR, item rates were considered based on February 2006, whereas in the awarded contract, item rates were based on FY 2010-11. MBPCL supplied cement, reinforcement, and structural steel free of cost under the awarded contract.

e) The change in dimensions of the HRT, Surge Shaft, Vertical Pressure Shaft (VPS), Lower Horizontal Pressure Shaft (LHPS), and Powerhouse compared to the original DPR specifications are as follows:

Table 13: Conveyance and Power Works dimension change

Sr. No	Description	Unit	DPR	As per Construction Drawing
1	**HRT**			
1.1	Shape		Line horseshoe Section	D-Shape
1.2	Diameter		4	4
1.3	Length	m	12080	12600
1.4	Slope		1:400	1:400
2	**ADITS**			
2.1	No. of Adits	No	3	5
2.22	Length of Adits	m	1031	1863.50
3	**Surge Shaft**			
3.1	Top Elevation	m	755.30	782.50
3.2	Bottom Elevation	m	696.30	694.40
3.3	Height	m	59	88.10

Sr. No	Description	Unit	DPR	As per Construction Drawing
3.4	Diameter	m	12	10
3.5	Orifice Diameter	m	1.70	1.55
4	**Pressure Shaft & Penstock**			
4.1	Penstock	m	Surface	Underground
	Length	m	900	0.00
	Diameter	m	3	-
4.2	Pressure Shaft			
	Diameter	m	3	3
	Length	m	79	318
4.3	Underground Penstock			
	Length	m	230	1115
	Diameter	m	3	3
4.4	Penstocks after bifurcation			
	Number	M	2	2
	Diameter	M	2.20	2.20
	Length	M	25	25

5.2.10 Further, reason for change in quantity and cost for HRT, Adits, Surge Shaft, Valve House, Penstock-Surface/Underground (UHPS, VPS and LHPS), Powerhouse, Tail Water Bay and Switch Yard, Hydro Mechanical & Penstock Steel liner works are as follows:-

i) Head Race Tunnel (HRT)

a) During the detailed designing and engineering phase, the length of the Head Race Tunnel (HRT) increased from 12.08 km to 12.60 km. This extension resulted in increased quantities of excavation, concreting, and reinforcement.

b) Additional excavation was necessary due to cavity formation at various locations caused by fragile rock and poor geological conditions.

c) The overbreak quantity increased from the 10% mentioned in the DPR to an actual 26% during execution, primarily due to poor geological conditions.

d) Various miscellaneous items, such as rock bolts, anchor bars, fore poling, grouting, and higher-grade shotcreting with wire mesh, which were not considered in the DPR, also contributed to the increased cost.

The cost for the HRT increased from Rs. 83.65 Crore in the original DPR to Rs. 236.72 Crore in actual execution, resulting in an increase of Rs. 153.07 Crore.

ii) ADITs

a) The DPR initially considered three Adits with a total length of 1,031.00 m. However, during the detailed design and engineering phase, five Adits with a total length of 1,863.50 m were constructed to facilitate faster de-fuming of dust and gases, as well as to improve excavation and ease of construction activities.

b) The increase in the length and size of the Adits led to higher quantities of excavation, concreting, and support systems.

c) Various miscellaneous items such as rock bolts, anchor bars, forepoling, grouting, and shotcreting, which were not considered in the DPR, were executed, resulting in an increase in cost.

The cost for the Adits increased from Rs. 10.58 Crore in the original DPR to Rs. 39.51 Crore in actual execution, resulting in an increase of Rs. 28.92 Crore.

iii) Surge Shaft

a) The Surge Shaft considered in the DPR had dimensions of 59.00 m in height and 12 m in diameter. During the detailed design and engineering phase, these dimensions were changed to 88.00 m in height and 12 m in diameter. This modification resulted in increased quantities of excavation, concreting, reinforcement, support systems, and miscellaneous items.

b) Various miscellaneous items such as rock bolts, anchor bars, forepoling, grouting, and shotcreting, which were not considered in the DPR, were executed, contributing to the increase in costs.

The cost for the Surge Shaft increased from Rs. 3.84 Crore in the original DPR to Rs. 10.84 Crore in actual execution, resulting in an increase of Rs. 6.99 Crore.

iv) Valve House: In the DPR, a gate was considered for the design. However, during the detailed design and engineering phase, a penstock protection valve was selected instead of the gate, which resulted in a cost of Rs.1.44 Crore.

v) Penstock-Surface/Underground (UHPS, VPS and LHPS)

a) In the DPR, the penstock was proposed to be partially surface type and partially underground, with a total length of 1234 meters (900 m surface type and 334 m underground). During the detailed design and engineering phase, the penstock was entirely shifted underground due to the surface area lying in a sinking zone. This change increased the penstock's length from 1,234 m to 1,498 m.

b) The excavation rate in the DPR was Rs. 200 per cubic meter for the 900 m of open excavation. However, the actual excavation for underground work was done at a rate of Rs. 1,890 per cubic meter for approximately 1,183 m.

c) Due to the increase in length, the quantities for excavation, concreting, reinforcement, and other miscellaneous items also increased.

The cost for the penstock increased from Rs. 13.47 Crore in the original DPR to Rs. 36.28 Crore in actual execution, resulting in an increase of Rs. 22.81 Crore.

vi) Powerhouse, Tail Water Bay and Switch Yard

a) Due to changes in the dimensions and design of the powerhouse complex, there was an increase in the quantities and costs of excavation, concreting, and reinforcement.

b) Various miscellaneous items such as cement plaster, random backfilling, grouting, and dewatering, which were not considered in the DPR, contributed significantly to the increase in cost.

The cost for the Powerhouse, Tail Water Bay and Switch Yard increased from Rs. 15.71 Crore in the original DPR to Rs. 37.21 Crore in actual execution, resulting in an increase of Rs. 21.49 Crore.

vii) Hydro Mechanical and Penstock Steel liner works

a) In the DPR, the total quantity for the penstock was estimated at 2,304 MT for a length of 1,234 m. The specified material was steel with a thickness of 20 to 25 mm, and the estimated cost for supply and erection was Rs. 1,17,318 per MT.

b) During detailed design and engineering, the penstock material was changed to an alloy steel of ASTM 517, Grade-F, and ASTM 537 Class-1, with thicknesses varying from 12 to 36 mm. The cost of this material ranged from Rs. 1,01,135 to Rs. 1,88,015 per MT, depending on the thickness.

c) The executed quantity for the underground penstock was 3,092.40 MT, compared to the estimated 2,304 MT in the DPR. This increase was due to the greater length, increased thickness, and higher grade of steel used. Consequently, the executed cost increased from the estimated cost in the DPR.

d) Various testing works were conducted under penstock erection, including radiography testing, ultrasonic testing of weld joints, 3D printing of bifurcation of the penstock, and non-destructive testing (NDT). The cost incurred for these testing works was Rs. 0.28 Crore.

e) An amount of Rs. 0.81 Crore was spent on the purchase of welding machines and other consumables necessary for the welding of penstock ferrules during the erection of the penstock.

f) An amount of Rs. 0.30 Crore was reimbursed to the hydro-mechanical (HM) contractor against the bank guarantee extension, which was required from time to time under the contract.

The cost for the Hydro Mechanical and Penstock Steel liner works increased from Rs. 27.88 Crore in the original DPR to Rs. 54.13 Crore in actual execution, resulting in an increase of Rs. 26.25 Crore.

viii) Additional Work Executed Under Conveyance & Powerhouse

a) **Rectification (HRT, ADITs):** Due to poor geological conditions, deformation of the support system, such as steel ribs and precast lagging, occurred at various places in the HRT and Adits due to lateral movement of rock mass. The additional work executed for rectification of HRT and Adits amounted to Rs. 4.17 Crore.

b) **Pilot Hole in Vertical Pressure Shaft:** A work order for a 1.0 m diameter pilot hole was awarded for drilling in the Vertical Pressure Shaft (VPS) by the raise boring method. The payment made against the pilot hole in the vertical pressure shaft was Rs. 8.61 Crore.

c) Other Payments to SEW:

i) Payment of Rs. 4.50 Crore was made against the agreement dated 29.01.2020.

ii) Amount paid to SEW against the recovery from various RA bills for excess consumption of material was Rs. 2.19 Crore.

iii) Amount paid to SEW for demobilization of manpower and equipment was Rs. 0.86 Crore.

d) **Admixture and Labour Charges:** Payment made against admixture and labour charges was Rs. 0.89 Crore.

e) Work Done on Actual Basis in ADITs: Payment made against work done on an actual basis in ADITs was Rs. 2.65 Crore.

f) Manpower & Machinery for Additional Work Executed in VPS: Payment made against manpower and machinery for additional work executed in VPS was Rs.0.59 Crore.

g) **Manpower and Machinery for Additional Work Executed in LHPS:** Payment made against manpower and machinery for additional work executed in Lower Horizontal Pressure Shaft (LHPS) was Rs. 0.39 Crore.

h) Powerhouse Cleaning, Dewatering & Labour Charges: Payment made against powerhouse cleaning, dewatering, and labour charges of Rs. 0.85 Crore.

i) **Surge Shaft Lining:** Payment made against additional work executed for surge shaft lining was Rs. 0.12 Crore.

j) **Slope Protection in Surge Shaft:** Payment made against additional work executed in the surge shaft for slope protection was Rs. 1.05 Crore.

k) **Insurance Cost:** Payment made against insurance was Rs. 2.64 Crore.

l) **Taxes Refunded to Contractor:** Payment made against taxes refunded to the contractor: Rs. 2.64 Crore.

m) **Cost Increase Due to Taxes & Duties:** In the DPR, the unit rates were considered as of February 2006, when service tax was not applicable. The increase in cost due to taxes is Rs. 47.21 Crore for civil work and Rs. 9.88 Crore for hydro-mechanical work.

5.2.11 It is observed that contract agreements allow alteration, addition and omission in the civil works. The relevant clause is reproduced below:

" Variations

The Engineer-in-charge shall have powers to make any variation of the form, quality or quantity of the works or any part thereof that may in his opinion necessary and for that purpose, if for any other reason it shall in his opinion be desirable, he shall have power to order the contractor to do and the Contractor shall do any of the following:-

g) Increase or decrease the quantity of any work included in the Contract.
h) Mit or substitute any such work,
i) Change the character or quality or kind of any such work.
j) Change the levels, lines, position and dimensions of any part of the works.
k) Execute additional work of any kind necessary for the completion of the works and no such variations shall in any way vitiate or invalidate the Contract, but the value, if any or all such variations shall be taken into account in ascertaining the amount of the contract price, and
l) Change any specified sequence, method or timing of construction of any part of the work."

5.2.12 The increase in costs associated with the Conveyance and Power House Works can be attributed to a series of factors that necessitated significant alterations from the original DPR. The transition from the DPR, prepared in 2006, to the execution phase in 2010 through ICB norms brought about changes in design, dimensions, and materials due to geological challenges and evolving construction considerations. These alterations included shifting from surface to underground structures, extending tunnel lengths, increasing the number and dimensions of Adits, and modifying the surge shaft dimensions. Additionally, variations in tax rates and contractual provisions for alterations further impacted project costs.

5.2.13 The detailed design and engineering phase revealed unforeseen geological conditions, necessitating adjustments in excavation, concreting, reinforcement, and support systems. For instance, the increase in the length and size of the HRT and the surge shaft, along with the decision to shift the penstock entirely underground, led to substantial cost escalations. Moreover, modifications in material specifications,

such as the use of alloy steel for the penstock, and additional works like rectifications, drilling pilot holes, and slope protection, further contributed to cost increases.

5.2.14 Contractual provisions allowing alterations and additions provided flexibility in responding to unforeseen challenges, albeit with implications for project costs. The increase of conveyance and power house works are as follows:-

Table 14: Increase in Conveyance and Power House Works

Particulars	Original Approved Estimated Cost (Rs. Crore)	Final Audited Cost incurred (Rs. Crore)	Actual Cost (Rs. Crore)
Head Race Tunnel	83.65	236.72	153.07
Adits	10.59	39.51	28.92
Surge Shaft	3.84	10.84	6.99
Valve House	0.00	1.45	1.44
Penstock-Surface/Underground (UHPS, VPS and LHPS)	13.48	36.29	22.81
Powerhouse, Tail Water Bay and Switch Yard	15.72	37.21	21.49
Hydro Mechanical & Penstock Steel liner works	27.88	54.13	26.25
HRT rectification (HRT, ADITs)	0.00	4.18	4.17
Pilot Hole	0.00	8.62	8.61
Payment to SEW	0.00	7.56	7.55
Admixture & Labour Charges	0.00	0.90	0.89
Actual Expenditure of ADITs	0.00	2.65	2.65
VPS Manpower & Supply	0.00	0.59	0.59
LHPS Manpower and Supply	0.00	0.36	0.39
PH Cleaning, De-watering and labour charges	0.00	0.86	0.85
Surge Shaft Lining	0.00	0.12	0.12
Slope Protection in Surge Shaft	0.00	1.05	1.05
Insurance Cost	0.00	7.01	7.01
Taxes refunded to contractor	0.00	2.65	2.64
Taxes and Duties	0.00	47.21	47.21
Taxes and Duties of HM Works	0.00	9.88	9.88
Other Miscellaneous Cost	0.00	4.70	4.69
Total	**155.15**	**514.52**	**359.37**

5.2.15 The details of DPR cost and the Completion Cost have been discussed till now. However, in order to better understand the actual expenses incurred at the time of Commercial Operation, the Award Cost for each contract and the details of works executed under each contract have to be analysed in detail. Hence, the details of the cost of works awarded under this head along with the detailed break-up of the completion cost incurred under each contract is summarized in the table below:

Table 15: Comparison of Award Cost and Completion Cost for Barrage, Conveyance and Powerhouse Works

Sr No.	Name of Contractor	Scope of work	Package	Award Cost (Rs. Crore)	Completion Cost (Rs. Crore)
1	SEW Infrastructure Limited	Civil Works for Barrage, Intake and Desilting Basin.	I	27.52	21.67
2	Moshvaraya Infrastructure Limited	Civil Works for Barrage, Intake and Desilting Basin.		24.17	34.71
3	Aimil Limited	Barrage Instruments		0.21	0.26
4	SEW Infrastructure Limited	Head Race tunnel including its Adits, Surge Shaft, UHPS, VPS & LHPS.	II	104.28	77.09
5	Moshvaraya Infrastructure Limited	Head Race tunnel including its Adits, Surge Shaft, UHPS, VPS & LHPS.		111.03	201.04
6	Leroy Infra Projects Private Limited			-	2.60
7	SEW Infrastructure Limited	Power House, TRC & Switchyard	III	25.53	4.27
8	Moshvaraya Infrastructure Limited /Everest Industries Ltd	Power House complex, Switchyard and Valve House, Tail Race Channel		15.37	18.13
9	**FOC Material-Landed Cost**				
9.1	Package -I	Cement, Reinforcement & Structural Steel , Consumables and Other Materials	I	-	27.75
9.2	Package -II		II	-	68.75
9.3	Package -III		III	-	14.07
10	**Taxes and Duties**				
10.1	Package I	Taxes and Duties	I	-	7.93
10.2	Package II	Taxes and Duties	II	-	43.74
10.3	Package III	Taxes and Duties	III	-	2.20
11	Texmaco Rail and Engg. Limited	Procurement, Manufacture/ fabrication, supply & services of the Penstock Steel (Part of Conveyance and Power House cost)	V	46.00	67.04
12	Chhattisgarh Metallks and Alloys Pvt. Ltd.	H & M (For Design, Procurement, Manufacture/ fabrication, supply & services of the Barrage gate Hydro-Mechanical works) (Part of Barrage cost)		12.79	16.36
13	Contractors All Risk Policy			-	6.48
14	Other payments related to Civil and HM works			-	9.49
Barrage And Conveyance & Power House Works Cost				**366.91**	**623.57**

5.2.16 The summary of works completed under each head is provided in the table below:

Table 16: Details of Barrage and Conveyance & Power House Works Executed as submitted by MBPCL

A. Summary of Barrage Works Cost

Particulars	Original Approved in DPR (Rs. Crore)	Final Audited Cost Incurred (Rs. Crore)
Barrage Civil Works Cost	28.18	84.47
Barrage Hydro-Mechanical Civil Works Cost	7.53	13.85
Taxes and Duties of Civil Works	0.00	8.08
Taxes and Duties of HM Works	0.00	2.05
Barrage Instrument & Man Power Supply	0.00	0.27
Total	**35.71**	**108.71***

** Note: There is a variation of Rs. 0.34 Crore between the actual item wise cost break-up and the summary submitted. However, since the details break-up are submitted for the major portion claimed and considering that the total project cost is certified by the Auditor, the increase of Rs. 109.05 Crore has been considered for approval.*

B. Summary of Barrage Works Cost

Particulars	Original Approved in DPR (Rs. Crore)	Final Audited Cost Incurred (Rs. Crore)
Conveyance and Power House Civil Works Cost	127.27	362.02
Conveyance and Power House Hydro Mechanical Civil Works Cost	7.53	54.13
HRT rectification (HRT, ADITs)	0.00	4.18
Pilot Hole	0.00	8.62
Payment to SEW	0.00	7.56
Admixture & Labour Charges	0.00	0.90
Actual Expenditure of ADITs	0.00	2.65
VPS Manpower & Supply	0.00	0.59
LHPS Manpower and Supply	0.00	0.36
PH Cleaning, De-watering and labour charges	0.00	0.86
Surge Shaft Lining	0.00	0.12
Slope Protection in Surge Shaft	0.00	1.05
Insurance Cost	0.00	7.01
Taxes refunded to contractor	0.00	2.65
Taxes and Duties	0.00	47.21
Taxes and Duties of HM Works	0.00	9.88
Other Miscellaneous Cost	0.00	4.70
Total	**155.15**	**514.52**

5.2.17 From the submissions made by MBPCL, it is observed that the works are executed at the agreed-upon rate by the contractors as per the contracts submitted by MBPCL.

5.2.18 Based on details submitted, it is observed that significant changes in the design of conveyance and power house works were made due to unforeseen conditions at the time of project execution, which could not have been envisioned at the project

planning phase. Further, these changes are approved by GoS through TEC and MBPCL has also provided the Lender's Engineer's Report by M/s. Energy Infratech Pvt. Ltd., in which these changes have been approved. As discussed earlier, the contracts provide for the variation in the scope of works with revision in price. The actual expenses incurred till the COD are substantiated by the Auditor's Certificate. Hence, it is suggested to allow **the claimed increase in cost of Rs. 359.37 Crore by MBPCL against Conveyance and Powerhouse Works.**.

5.2.19 The Comparison of the Cost as per the DPR, Works awarded based on the Bids held and the completion cost as submitted by MBPCL is summarized in the table below:

Table 17: Cost Comparison for Barrage, Conveyance and Power House Works

Description	Original Approved Estimated Cost as per DPR (Rs. Crore)	Award Cost (Excluding Cement & Steel Cost) (Rs. Crore)	Final Audited Cost incurred (Rs. Crore)
Barrage, Conveyance and Power House Works	190.86	366.91	623.57

5.3 E&M Works Including Transmission Lines

MBPCL Submission

5.3.1 MBPCL submitted that variation in cost under this head in price is due to the reasons stated below:

a) **Change in Capacity of E&M Equipment**: Originally envisaged capacity was 96 MW. Later, taking advantage of higher inflows available during the monsoon period, the project capacity was enhanced to 113 MW. Correspondingly, the capacity of Auxiliary equipment such as Main Inlet Valve had to be proportionally increased to accommodate the Higher Capacity Plant.

b) **Exchange Rate fluctuations:** The exchange rate for USD and Euro at the time of award of contract was Rs. 42.0 and Rs. 64.0, respectively. The average exchange rates for the completed Project works out to be Rs. 71.45 and Rs. 79.72 for USD and Euro, respectively. Due to increase in the Foreign Exchange rate, the cost of E&M works has increased by around Rs. 9.68 Crore.

c) **Increase in Taxes and Duties:** The taxes and duties have increased due to increase in the basic cost of E&M Works.

d) **Change in Power Evacuation System:** The original power evacuation system was conceived to deliver power at Rangpo Pooling station of PGCIL, which was at a distance of 1.5 km from Power House. Later on, PGCIL changed the delivery point to Samardong, 7.5 km from the Power House, resulting into longer length of transmission line. Also, the earlier conceived conventional 220 kV Sub-Station was changed by PGCIL to a technologically superior Gas Insulated Sub-station (GIS). GIS offers greater protection and stability of the grid besides occupying much smaller space.

5.3.2 The increase in cost as claimed by MBPCL is as below:

Table 18: Increase Cost in E&M Works Including Transmission Lines

Description	Original Approved Estimated Cost (Rs. Crore)	Final Audited Cost incurred (Rs. Crore)	Difference (Rs. Crore)	% Variation
E&M Works excluding Transmission Lines	112.1	153.12	41.02	36.59%
Transmission Lines	20.06	35.91	15.85	79.01%

ABPS Infra Observation

5.3.3 In response to the clarification sought regarding the increase in E&M Works Including Transmission Lines, MBPCL submitted that the cost increase for the following reasons:-

a) The DPR of 96 MW Rongnichu HEP was prepared in the year 2006. The cost estimated for the components was considered with base of February 2006. The total cost of E&M works was estimated in the DPR as Rs. 112.10 Cr. excluding transmission line.

b) During the detailed design and engineering phase, the rated capacity enhanced from 96 MW (2 x 48 MW) to 113MW (2 x 56.5 MW). The rated output of turbine, generator, transformer, and size of main inlet valve increased. In DPR, the cost of penstock protection valve was not considered.

5.3.4 Further, reasons and comparison as per the original DPR and actual cost incurred in respect to change in in capacity of E&M equipment, exchange rate fluctuations, increase in taxes and duties and change in power evacuation are as follows:-

i) **Change in capacity of E&M equipment:** The cost increased by Rs. 128.12 Crore due to the change in the capacity of the main Electro-Mechanical (E&M)

equipment.

ii) **Exchange Rate Fluctuations:** Initially, at the time of awarding the work, the exchange rate stood at Rs. 71 per EURO and Rs. 64.2 per USD for imported goods such as generators, turbines, and PPVs. However, by the time of dispatch or billing, the exchange rates had increased to approximately Rs. 79 per EURO and Rs. 71.45 per USD. This fluctuation resulted in a cost increase of Rs. 9.06 Crore.

iii) **Increase in Taxes & Duties:** In the DPR, taxes and duties were estimated at 16% as excise duty. However, the actual taxes and duties levied were at a higher rate of 18% in the form of GST. Further, other duties on imported goods, such as turbines, generators, and PPVs, ranged from 25% to 30% in aggregate custom duty. Moreover, other custom clearance expenses were incurred, adding to the actual cost. Consequently, the overall cost incurred under taxes and duties amounted to Rs. 27.20 Crore, compared to the estimated Rs. 11.28 Crore in the DPR. This resulted in an increase in cost of Rs. 15.92 Crore.

5.3.5 The cumulative effect of the change in the capacity of E&M equipment, exchange rate fluctuations, and the increase in taxes and duties led to a total cost increase of Rs. 41.02 Crore for E&M works excluding Transmission lines. The head wise break-up of cost increase in E&M works excluding Transmission lines is shown below

Table 19: Head wise break-up of cost increase in E&M works excluding Transmission lines

Sr. No.	Particulars	As per DPR (Rs. Crore)	Actual amount (Rs. Crore)	Difference amount (Rs. Crore)
1	Basic Supply price of E&M cost	75.43	105.19	29.75
2	Services	6.32	7.92	1.60
3	Transportation and Insurance	4.90	3.35	(1.55)
4	Taxes & Duties	14.55	27.58	13.02
5	Exchange Fluctuations		9.06	9.06
6	Contingencies 3%	2.88	-	(2.88)
7	Establishment charges @ 6%	5.95	-	(5.95)
8	Tools and Plant	0.99	-	(0.99)
9	Audit and accounting	1.05	-	(1.05)
	Total	**112.10**	**153.11**	**41.02**

iv) **Change in power evacuation system:** The transmission line work was initially estimated at Rs. 20.06 Crore for a 2 km length in the DPR. However, during execution, the length of the transmission line extended to 7.2 km. As a result, the expenditure incurred for the construction of the transmission line amounted to Rs. 35.91 Crore. A comparison between the DPR cost and the actual execution cost is shown below:-

Table 20: Increase in Cost due to change in power evacuation system

Transmission line & Power evacuation system				
Sr. No.	Particulars	As per DPR (Rs. Crore)	As per actual execution (Rs. Crore)	Difference amount (Rs. Crore)
1	Supply of tower, line material and accessories for erection testing & commissioning of 220KV Double circuit Transmission Line	20.06	6.78	(13.27)
2	Erection, Testing & commissioning of 220KV Double circuit Transmission Line	Included above	11.26	11.26
3	Pooling substation 220KV switchyard	Not Considered	0.59	0.59
4	GIS Bay	Not Considered	16.28	16.28
5	GIS Bay building extension	Not Considered	0.40	0.40
6	Tower protection work	Not Considered	0.45	0.45
7	Misc. (re alignment of TL and other misc. site exps.)	Not Considered	0.11	0.11
	Total amount	**20.06**	**35.91**	**15.85**

5.3.6 Based on the aforementioned observations, it is noted that changes in Electrical & Mechanical (E&M) Works are correlated with several factors. These include enhancements in the generating capacity of the Project, fluctuations in exchange rates, increases in taxes and duties due to changes in laws, and modifications in the scope of the evacuation system.

5.3.7 Considering that the causes outlined are outside the control of MBPCL, it is suggested to allow **the claimed increase of Rs. 56.87 Crore against E&M Works including Transmission Lines.**.

5.3.8 Further, the detailed comparison of the Cost of Awarded Works and the Completion Cost of "E&M Works Including Transmission Lines" is provided below:

Table 21: Comparison of Cost of Works Awarded and Completion Cost of E&M Works

Sr No.	Name of Contractor	Scope of work	Package	Award Cost (Rs. Crore)	Completion Cost (Rs. Crore)
Electro Mechanical					
A	Main Plant and Equipment				
1	Litostroj Power d.o.o.	Turbine & Auxiliaries, Cooling & Drainage water System, HPU & Governor (Supply and Service)	IV	33.96	50.55
1.1			IV		0.40
1.2			IV		0.04
2	M/s CG Electric Systems Hungary Zrt	Generator & Auxiliaries (Supply and Service)	IV	42.29	60.36

Sr No.	Name of Contractor	Scope of work	Package	Award Cost (Rs. Crore)	Completion Cost (Rs. Crore)
3	Voith Hydro Pvt Ltd	Contract for Work of Design, Engineering, Manufacturing, Supply, Inspection, testing at works of Electro Mechanical Equipment's (Supply and Service)	IV	101 Crore including Service Contract	1.08
4	Sanelec Excitation Systems Pvt Ltd	Digital Static Excitation System & Mandatory Spares	IV	3.00	3.55
4.1		Supply of Advantech HMI with related Accessories & Cable	IV	0.05	0.08
4.2		220KV DC Tripping Coil, for DC field Breaker & Handling Charges	IV	0.0069	0.01
5	Powersol Engineers & Consultants Pvt Ltd		IV	5.72	6.75
6		Design, Procurement, Fabrication/Manufacture and Supply of 1650mm Main Inlet Valve (PN50) and its accessories with spares & Proximity Sensor Connectors		7.00	8.58
B.	**Balance of Plant (BOP)**				
1	PROLEC GE India (Indo Tech Transformers Limited)	Supply of 60/75 Generator Transformer Spare Bushing and Supply of 10 MVA Transformer Spare Bushing	IV	0.13	0.16
2	Indo Tech Transformers Limited	Deputation of Service Engineer for Supervision of Erection, Testing & Commissioning of 2nos 75 MVA and 1 Nos 10 MVA Transformer extra 5 man days service required. 10000*5 days	IV	0.005	0.01
3	Unique Industrial Handlers Pvt Ltd	EOR CRANE	IV	1.3145	1.55
4	Details of Misc. BOP material	BOP-Electrical, Mechanical, Automation System and others	IV		19.16
5	Other payments such as insurance and others				0.85
	Sub-Total (A+B)			**194.49***	**153.12**
C.	**Power Evacuation System**				
A	**Powersol Engineer and Consultant P. Ltd. (TL)**	Transmission Line	V	14.55	18.05
B	**GIS Bays, GIS Bays Building Extension, Pooling Sub Station Switchyard, Tower Protection Work and Others & Consultancy**				

Sr No.	Name of Contractor	Scope of work	Package	Award Cost (Rs. Crore)	Completion Cost (Rs. Crore)
1	Hyosung T & D India Pvt. Ltd. (Supply)	GIS Bays	V	11.54	13.59
2	Powergrid Corporation of India Limited	Consultancy		-	2.57
3	Building				
3.1	NLM Infra Projects	GIS Bays Building Extension		0.32	0.41
3.2	NLM Infra Projects	Pooling Sub Station Switchyard		0.49	0.59
4	Dinesh Acharya And Others	Tower Protection Work And Others		0.215	0.46
5	Others				0.24
	Sub-Total (A+B)			**27.13**	**35.91**
	Total			**221.62***	**189.03**

(includes Rs. 101 Crore contract awarded to M/s. Voith Hydro, which was later abandoned)

5.3.1 Based on details submitted and considering the contract documents submitted by MBPCL, it is clear that the works under E&M Works are awarded under Bulk Rate contracts and that the increase in the completion cost from the award price is mainly due to change in the scope of the contract. Further, these changes are approved by GoS through TEC and MBPCL has also provided the Lender's Engineer's Report by M/s. Energy Infratech Pvt. Ltd. in which these changes have been approved. As discussed earlier, the contracts provide for the variation in the scope of works with revision in price. The actual expenses incurred till the COD are substantiated by the Auditor's Certificate. Hence, it is suggested to consider and allow **the Completion Cost as claimed by MBPCL.**

5.4 Preliminary Expenses

MBPCL Submission

5.4.1 MBPCL has claimed increase in Preliminary Expenses due to two main reasons viz.,

a) **Design and Engineering Expenses:** Unavoidable changes in the design and engineering of the Project components due to changed location of barrage, Adit-I, Adit-II, Surge shaft, change in arrangement of penstock from surface to underground.

b) **Increase in Taxes and Duties**: The rate of Service tax increased from 12.36% to 15% and finally to 18% under GST regime.

Table 22: Increase in Cost of Preliminary Expenses

Description	Original Approved Estimated Cost (Rs. Crore)	Final Audited Cost incurred (Rs. Crore)	Difference (Rs. Crore)	% Variation
Preliminary	10.00	20.50	10.50	105.00%

ABPS Infra Observation

5.4.2 In response to the clarification sought regarding the increase in preliminary expenses, MBPCL submitted that the rise in costs was primarily due to extensive investigation works completed prior to the preparation of the DPR. Additional geological investigations and topographical surveys were necessary because of changes in the locations of the Barrage, Adit-I, Adit-III, and Surge Shaft. The penstock arrangement was modified from a combination of surface and underground to entirely underground, including the addition of a Vertical Pressure Shaft. These expanded investigation efforts contributed to higher project consultancy expenses under the category of Preliminary Expenses.

5.4.3 Furthermore, the tax rate for professional consultancy services previously ranged from 12.36% to 15%. However, with the introduction of GST, the rate increased to 18%, leading to a substantial rise in costs. The year-wise rates of Service Tax and GST are as follows:

Table 23: Tax rate applicable

Sr. No.	Period	Rate of Tax
1.	24.02.2009 to 31.03.2012	10.30%
2.	01.04.2012 to 31.05.2015	12.36%
3.	01.06.2015 to 14.11.2015	14%
4.	15.11.2015 to 31.05.2016	14.50%
5.	01.06.2016 to 30.06.2017	15%
6.	w.e.f. 01.07.2017 Rate of GST	18%

5.4.4 It has been observed that the changes in the design and engineering of the project components are due to geological surprises encountered during the project. MBPCL has provided copies of consultancy services agreements to substantiate their claim for the costs incurred in design and engineering. Additionally, as per the submitted agreements, the taxes and duties are passed through to MBPCL. The relevant clause is reproduced below:

*"**Consultancy Fee:***

……..

The fee is exclusive of:-

Applicable Taxes and duties

……."

"Service tax at 11.2% or as may be levied by the govt. from time to time or any other Tax central or local would be extra to be reimbursed by the Client."

5.4.5 Given that the changes in the design and engineering of the project were due to unforeseen geological conditions and the increase in taxes and duties were beyond the control of MBPCL, it is suggested to consider and allow **the claimed increase of Rs. 10.50 Crore for preliminary expenses.**

5.5 Land Expenses

MBPCL Submission

5.5.1 MBPCL has claimed increase in Land Acquisition due to the following reasons, viz.,

a) Building alternative approach road to Power House,

b) Acquisition of land for Adit-2B (Forest/Govt. land)

c) Additional land required for establishing Muck Dump Area for handling additional muck excavated as a result of poor geology, increased over break, etc.

d) Extension of lease agreement till completion of construction work (Short term lease Land).

e) Additional compensation, crop compensation, damage compensation and other compensation had to be paid, as per the order of district administrative authorities.

Table 24: Increase Cost in Land Acquisition

Description	Original Approved Estimated Cost (Rs. Crore)	Final Audited Cost incurred (Rs. Crore)	Difference (Rs. Crore)	% Variation
Land	10.00	25.62	15.62	156.20%

ABPS Infra Observation

5.5.2 In response to the clarification sought regarding the increase in land acquisition expenses, MBPCL submitted that these expenses include payments for lease rent towards acquiring 99-year leasehold land and payments for acquiring government and forest land.

5.5.3 Upon reviewing the MBPCL submission and relevant documents presented, it has been observed that the increase in land acquisition costs is primarily due to changes in the design and engineering of the project components, delays in project implementation, and changes in law. The major sub-head wise break-up of land acquisition costs is as follows:-

Table 25: Land Expenses

Particulars	Actual Cost (Rs. Crore)
99 Year lease Hold Land	7.67
Acquisition of Govt Land	3.66
Forest Land	13.17

5.5.4 Further, MBPCL has provided the details of increase in the land expenses under different heads as below:

Table 26: Break up of Land Expenses

Particulars	Actual Cost (Rs. Crore)
Cost of Approach Road to various sites	1.44
Crop Compensation and CAT plan & Other Compensation	13.30
Add Compensation & Other Const.	7.88
Adit II B	1.97
Muck Dumping	0.35
Short Term Lease Other	0.69
Total	**25.62**

5.5.5 Considering that the changes in design and engineering of the project due to geological surprises and delay due to land acquisition are beyond the control of MBPCL, it is suggested to consider and allow **the claimed increase of Rs. 15.62 Crore for land acquisition.**

5.6 Miscellaneous Expenses

MBPCL Submission

5.6.1 MBPCL submitted that this head is composed of expenditure primarily incurred towards security expenses and other social activities, & maintenance. Social activities pertained to the expenditure incurred on activities undertaken pursuant to demands/requests by the local Authorities /Local Bodies /NGOs etc. As against the original estimates of Rs. 5.40 Crore, the final completion cost as on COD under this head is claimed as Rs. 10.59 Crore.

Table 27: Increase Cost in Miscellaneous Expenses

Description	Original Approved Estimated Cost (Rs. Crore)	Final Audited Cost incurred (Rs. Crore)	Difference (Rs. Crore)	% Variation
Miscellaneous	5.40	10.59	5.19	96.11%

ABPS Infra Observation

5.6.2 Upon reviewing MBPCL's submission and the accompanying documents, it has been observed that the factors contributing to the increase of miscellaneous costs for the project can be primarily attributed to security measures, diesel consumption, hiring charges for plant and machinery, as well as various site-related expenditures such as IRB project expenses, labour charges, and site maintenance activities. Further, allocations for social initiatives, donations, and the procurement of tools and tackles also contributed to increase of the overall miscellaneous costs.

5.6.3 The sub-head wise break-up of Rs. 10.59 Crore miscellaneous cost is provided below:-

Table 28: Sub-head wise break-up of Miscellaneous cost

Particulars	Actual Cost (Rs. Crore)
Security Expenses	8.88
Diesel Expenses	0.76
Hiring Charges (Plant and Machinery)	0.70
IRB Site Project Expenses	0.08
Labour Charges	0.05
Site Tree Filling and Other Work	0.01
Others	0.05
Misc. tools and Tackles	0.02
Total	**10.59**

5.6.4 It is observed that the increase in majority of the miscellaneous expenses like security expenses, hiring charges, labour charges, etc., from the miscellaneous expenses estimated as per the DPR is primarily on account of time overrun. **As discussed in Time Over Run section, it is suggested to condone 66% of time over run for allowing the costs. Hence, out of the total increase of Rs. 5.19 Crore, only 66%, i.e., Rs. 3.41 Crore is suggested to be allowed in line with the discussions made in the time overrun section.** Accordingly, the Miscellaneous expenses to be allowed works out as follows:

Table 29: Miscellaneous Cost proposed to be allowed

Description	Original Approved Estimated Cost (Rs. Crore)	Final Audited Cost incurred (Rs. Crore)	Difference (Rs. Crore)	Proposed (Rs. Crore)
Miscellaneous	5.40	10.59	5.19	8.81

5.7 Other Infrastructure

MBPCL Submission

5.7.1 MBPCL submitted that the key reasons for increase of cost in the head as below:

a) **Increase of Government Rates for Labour contracts:** As per the Implementation Agreement, most of the works towards road and buildings had to be awarded to the local contractors at government approved rates. The appraised cost by Lenders under this head is Rs. 12.78 Crore. However, with the revision in Sikkim Government Schedule of Rates, 2012, the cost of such contracts increased materially.

b) **Redevelopment of facilities:** The earthquake, which rocked Sikkim in the year 2011, triggered several landslides in the Project areas and damaged the approach roads, culverts, retaining walls and drains of the project. The same, thus, had to be re-developed. The steel bridge across Rognichu River upstream of barrage site got washed away due to unprecedented high flood and had to be re-built. Owing to frequent landslide during monsoons, the approach roads and protection walls were damaged at several locations and had to be repaired and reconstructed multiple times leading to incremental cost. Besides, the construction cost of approach road, culverts and embankment for Adit 2B of 1.3 km and permanent approach road of 1.6 km for power house was not considered in the initial

estimates. With the elongation of the project construction phase, expenditure on road maintenance also increased.

5.7.2 The increase in cost as claimed by MBPCL is as below:

Table 30: Increased Cost of Other Infrastructure

Description	Original Approved Estimated Cost (Rs. Crore)	Final Audited Cost incurred (Rs. Crore)	Difference (Rs. Crore)	% Variation
Other Infrastructure	12.77	43.78	31.01	242.83%

ABPS Infra Observation

5.7.3 It is observed that the MBPCL contract agreements have provision for price variation for the increase or decrease in rates and price of labour. The price adjustment formula for the labour contract was based on the all-India consumer price index and the labour employed by contractor and sub-contractor were required to be paid wages not less than the wages defined in the Sikkim State Government Labour Regulations. The relevant extract of the contract agreement is as follows:-

*" If after 30 days prior to the closing date of submission of tender and during the currency of the contract, there is any increase or decrease in the cost of labour reflected in the "All India Consumer Price Index" the corresponding increase or decrease in the payments to the contractor on this account shall be VL = 0.85 * (PL)/100 X (RI(Li - Lo))/(Lo)*

…….

Any increase, direct or indirect, in cost of construction due to any increase in minimum wage or increase in provision of labour amenities and benefits in excess of those applicable on the 30 days prior to the closing date of submission of tender, shall not be payable to Contractor, except as per the provisions of Price adjustment clause."

……..

"The contractor shall pay to labour employed by him either directly or through sub-contractors wages not less than fair wages as defined in the Sikkim State Government's Labour Regulations.

The Contractor shall in respect of labour employed by him or his subcontractors comply with or cause to be complied with the Contractors Labour Regulations of Government of Sikkim in regard to all matters provided therein."

5.7.4 Further, it has been observed that the redevelopment of facilities was necessitated by the 2011 earthquake in Sikkim, which triggered landslides and inflicted damage on project infrastructure such as roads, culverts, and retaining walls. Reconstruction efforts were imperative due to a steel bridge over the Rognichu River being washed away by floods, necessitating its restoration. Furthermore, frequent monsoon landslides resulted in recurrent damage to roads and walls, contributing to heightened costs. Initial estimates did not encompass certain construction expenses, further augmenting costs. Moreover, prolonged project construction phases incurred elevated expenditure on road maintenance.

5.7.5 In light of the aforementioned factors, it is evident that the escalation in Other Infrastructure expenses is a direct consequence of uncontrollable variables. Hence, it is suggested to consider and allow **the claimed increase of Rs. 31.01 Crore by MBPCL regarding Other Infrastructure expenses.** . This acknowledgment underscores the necessity of accommodating unforeseen expenditures arising from external circumstances beyond the project's control, thereby ensuring fairness and transparency in financial assessments.

5.8 Environment and Ecology

MBPCL Submission

5.8.1 MBPCL has submitted that it had to abide by the statutory stipulations of Biodiversity Conservation Management Plan for Catchment Area Treatment (CAT). Accordingly, the overall expenditure under this head as per statutory requirement is considered as Rs. 6.50 Crore (Catchment Area Treatment Rs. 72,02,000 + Biodiversity Conservation and Management Rs. 5,78,26,000).

Table 31: Increased Cost for Environment and Ecology

Description	Original Approved Estimated Cost (Rs. Crore)	Final Audited Cost incurred (Rs. Crore)	Difference (Rs. Crore)	% Variation
Environment and Ecology	5.00	6.50	1.50	30.00%

ABPS Infra Observation

5.8.2 It has been observed that the changes in environment and ecology expenses are due to statutory stipulations of Biodiversity Conservation Management Plan for

Catchment Area Treatment (CAT). Therefore, taking into consideration that the increase is due to statutory stipulations, it is suggested to allow **the increase of Rs. 1.50 Crore claimed by MBPCL against Environment and Ecology.**

5.9 Establishment

MBPCL Submission

5.9.1 MBPCL submitted that calculation of establishment expenses has been considered at 10% of Hard cost of the project (excluding E&M works, transmission line and land). Establishment cost has increased due to increase in the timelines and overall increase in project cost.

5.9.2 The increase in cost as claimed by MBPCL is as shown below:-

Table 32: Increase Cost in Establishment

Description	Original Approved Estimated Cost (Rs. Crore)	Final Audited Cost incurred (Rs. Crore)	Difference (Rs. Crore)	% Variation
Establishment	19.65	71.48	51.83	263.77%

ABPS Infra Observation

5.9.3 It is observed that the changes in establishment expenses are linked to the delay in the project and the increase in the overall hard cost.

5.9.4 The sub-head wise break-up of Rs. 71.48 Crore establishment cost is provided below:-

Table 33: Sub-head wise break-up of establishment cost

Sr. No.	Particulars	Amount (Rs. Crore)
1	**Salary & Allowances**	
	Salary & Allowances including Reimbursement of exps.	35.68
	Gratuity expenses	0.23
	Directors Remuneration & Allowances	2.27
	Expenses reimbursement to Director	0.21
	Employer's Contribution to PF	0.87
	Leave Encashment	0.43
	Staff Welfare Expenses (Medical Insurance)	0.13
	Staff Welfare Expenses (Others)	0.18
	Board Meeting Exps (Directors Sitting Fees and Others)	0.31
2	**Travelling and Conveyance exps. including Vehicle Hiring and others**	11.72
3	**Rent, rates and taxes including electricity exps.**	5.62
4	**Mess expenses and other related expenditure**	2.37
5	**Audit Fees and exps.**	0.20

Sr. No.	Particulars	Amount (Rs. Crore)
6	**Insurance expenses of vehicles and assets**	0.69
7	**Office expense including telephone, internet, printing & stationery and other exps.**	8.87
8	**Administrative assets including vehicles and other assets**	1.70
	Total	**71.48**

5.9.5 It is observed that the increase in establishment cost is primarily on account of time overrun. **As discussed in Time Over Run section, it is suggested to condone 66% of time over run for allowing the costs. Hence, out of the total increase of Rs. 51.83 Crore, only 66%, i.e., Rs. 34.09 Crore is suggested to be allowed in line with the discussions made in the time overrun section.** Accordingly, the establishment cost to be allowed works out as follows:

Table 34: Establishment Cost proposed to be allowed

Description	Original Approved Estimated Cost (Rs. Crore)	Final Audited Cost incurred (Rs. Crore)	Difference (Rs. Crore)	Proposed (Rs. Crore)
Establishment	19.65	71.48	51.83	53.74

5.10 Other cost related to Cost overrun

ABPS Infra Observation

5.10.1 MBPCL in the Petition submitted the cost over-run of the project as Rs. 1,120 Crore and in subsequent para, provided head wise break-up of major factors of cost over-run, which works out to Rs. 1,089 Crore. However, break-up of remaining cost over-run of Rs. 31 Crore details was not provided in the Petition. In this regard, clarification was sought. In response, MBPCL submitted the break up and reasons for remaining cost increase of Rs. 31 crore, as shown below:

Table 35: Head-wise Cost Increase for Other Cost

Description	Original Approved Estimated Cost (Rs. Crore)	Final Audited Cost incurred (Rs. Crore)	Difference (Rs. Crore)
Buildings	7.51	2.52	(5.00)
Plantation	0.60	0.63	0.03
Special Tools and Plants	3.22	1.90	(1.33)
Losses on stock	0.21	0.00	(0.21)
Tools and Plants	2.46	1.52	(0.94)
Escalation Cost	46.77	84.99	38.22
Total	**60.77**	**91.56**	**30.78**

5.10.2 From the above table, it can be observed that the remaining cost overrun is attributable to plantation and escalation costs, whereas the cost of remaining components were lower than the original cost in the DPR.

5.10.3 The plantation cost increased by Rs. 3 lakh due to increase in the price of saplings.

5.10.4 It is observed that the increase in escalation cost is primarily on account of time overrun. **As discussed in Time Over Run section, it is suggested to condone 66% of time over run for allowing the costs. Hence, out of the total increase of Rs. 38.22 Crore, only 66%, i.e., Rs. 25.14 Crore is suggested to be allowed in line with the discussions made in the time overrun section.** Accordingly, the escalation cost to be allowed works out to be as follows:

Table 36: Escalation Cost proposed to be allowed

Description	Original Approved Estimated Cost (Rs. Crore)	Final Audited Cost incurred (Rs. Crore)	Difference (Rs. Crore)	Proposed (Rs. Crore)
Escalation Cost	46.77	84.99	38.22	71.91

5.11 Interest During Construction

MBPCL Submission

5.11.1 MBPCL has submitted the details of capital cost approved at various stages of the Project. From the submissions made, it can be observed that the IDC has increased from Rs. 45.71 Crore as approved in the Preliminary DPR to Rs. 529.68 Crore as on COD of the Project. The major reason for the increase is the delay of 111 months and the change in the scope of work due to geological surprises.

ABPS Infra Observation

5.11.2 The Original Approved Estimated Project Cost was Rs. 446.41 Crore excluding IDC with IDC of Rs. 45.71 Crore, which works out to ~10.23% of the Project Cost excluding IDC. Considering the revised Hard Cost of Rs. 1050.03 Crore as proposed in this report, the revised base case IDC works out to Rs. 107.47 Crore. Hence, the IDC on account of time overrun works out to Rs. 422.21 Crore considering the actual IDC of Rs. 529.68 Crore. It is observed from the section on Time Overrun that MBPCL has not been able to justify the complete delay of 111 months satisfactorily with proper justification along with the reason for delay and its timelines. **Hence, it is proposed**

that the IDC due to time overrun be approved considering that 66% of the additional IDC is due to delay on account of various uncontrollable factors. Hence, the IDC proposed to be considered and allowed is as below:

Table 37: IDC To be Allowed (Rs. Crore)

Description	Amount
IDC As per DPR	45.71
Cost Excluding IDC as per DPR	446.61
% IDC	10.23%
Allowable Hard Cost	1050.03
IDC proportional to Hard Cost	107.47
Actual IDC	529.68
IDC on account of time overrun	422.21
Increase in IDC Allowable due to Time Overrun	277.69
IDC Allowable	**385.16**

5.12 Capital Cost Considered as on COD

5.12.1 Based on the observation above, as against the Capital Cost of Rs. 1,612.31 Crore claimed by MBPCL, the Capital Cost proposed to be considered is summarized in the table below:

Table 38: Summary of Capital Cost as on COD of the Project (Rs. Crore)

Description	Original Estimated Cost	Final Audited Cost	Difference	Proposed to be Allowed
CIVIL WORKS				
I - Works				
A - Preliminary	10.00	20.50	10.50	20.50
B - Land	10.00	25.62	15.62	25.62
C - WORKS	35.71	109.05	73.34	109.05
J - WORKS - CONVEYANCE & POWERHOUSE	155.15	514.52	359.37	514.52
K - BUILDINGS	7.51	2.52	(4.99)	2.52
M - PLANTATION	0.60	0.63	0.03	0.63
O - MISCELLANEOUS	5.40	10.59	5.19	8.81
Q - SPECIAL TOOLS AND PLANT	3.22	1.90	-1.32	1.90
R – COMMUNICATION (OTHER INFRASTRUCTURE)	12.77	43.78	31.01	43.78
X - ENVIRONMENT AND ECOLOGY	5.00	6.50	1.50	6.50
Y. Losses on stock @ 0.1% of (I-Works less A, B, M, O, Q, X and P)	0.21	0.00	(0.21)	0.00
Total I- WORKS	**245.58**	**735.61**	**490.03**	**733.83**
II - Establishment @ 8% (of cost of I works)	19.65	71.48	51.83	53.74
III - Tools and Plants @ 1% Cost of I works	2.46	1.52	(0.94)	1.52
Total Civil Cost	**267.69**	**808.61**	**540.92**	**789.09**

Description	Original Estimated Cost	Final Audited Cost	Difference	Proposed to be Allowed
E&M Works excluding Transmission Lines	112.1	153.12	41.02	153.12
Transmission Lines	20.06	35.91	15.85	35.91
Total Construction Cost	**399.85**	**997.64**	**597.79**	**978.12**
Escalation Cost	46.77	84.99	38.22	71.91
Total Project Cost Before IDC	**446.61**	**1,082.63**	**636.02**	**1,050.03**
Interest During Construction	45.71	529.68	483.97	385.16
Total Cost Including Escalation & IDC	**492.32**	**1,612.31**	**1,119.99**	**1,435.19**

5.12.2 Furthermore, benchmarking of capital costs, including hard costs and IDC claimed by hydro power plants and approved by SERCs, has been conducted for capacities ranging from 65 MW to 160 MW over the past five years from the COD of the Rongnichu Hydro Power Plant. The benchmarking reveals that the claimed hard costs ranged from Rs. 8.13 to 15.18 Crore/MW, compared to the approved range of Rs. 8.13 to 12.75 Crore/MW. Similarly, the claimed IDC costs ranged from Rs. 1.56 to 5.96 Crore/MW, versus the approved range of Rs. 1.50 to 3.36 Crore/MW. The overall claimed Capital Cost per MW ranged from Rs. 10.62 to 19.96 Crore/MW, against the approved range of Rs. 10.26 to 14.31 Crore/MW. The hydro power plants considered for capital cost benchmarking are listed below:

Table 39: Benchmarking of Capital Cost

Sr. No	Plant	Developer	Commission	Capacity (MW)	Location	COD	Hard Cost (Rs.Crore/MW)		IDC (Rs.Crore/MW)		Total Cost (Rs.Crore/MW)	
							Claimed	Approved	Claimed	Approved	Claimed	Approved
1	Vyasi HEP	UJVN Limited	UERC	120	Dehradun, Uttarakhand	Unit I- 24.05.2022 Unit II- 22.04.2022	12.35	11.63	3.62	1.97	15.97	13.60
2	Sawra Kuddu Hydro Electric Project	HP Power Corporation Ltd.	HPERC	111	District- Shimla, Himachal Pradesh	21.01.2021	15.18	11.99	4.78	1.71	19.96	13.70
3	PARE hydroelectric power plant (2 x 55 MW)	NEEPCO	CERC	110	District- Pampum Pare, Arunachal Pradesh	Unit-II- 21.05.2018 Unit-I- 28.05.2018	12.75	12.75	1.56	1.56	14.31	14.31
4	Sainj Hydro Electric Project	HP Power Corporation Ltd.	HPERC	100	District- Kullu, Himachal Pradesh	04.09.2017	9.64	9.29	2.53	1.57	12.17	10.86
5	Integrated Kashang Hydro Electric Project (IKHEP) Stage-I	HP Power Corporation Ltd.	HPERC	65	District- Kinnaur, Himachal Pradesh	31.03.2017	12.94	11.03	2.37	1.50	15.30	12.53
6	Sarju Small Hydro Power Project	Uttar Bharat Hydro Power Pvt. Ltd	UERC	12.6	District- Bageshwar, Uttrakhand	28.05.2016	8.92	8.68	5.96	3.36	14.89	12.04
7	Teesta Low Dam Power Station, Stage-IV	NHPC	CERC	160	Kalijohra, West Bengal	Unit I- 11.3.2016 Unit II- 31.3.2016 Unit III- 17.7.2016 Unit IV- 19.8.2016	8.13	8.13	2.49	2.13	10.62	10.26

Sr. No	Plant	Developer	Commission	Capacity (MW)	Location	COD	Hard Cost (Rs.Crore/MW)		IDC (Rs.Crore/MW)		Total Cost (Rs.Crore/MW)	
							Claimed	Approved	Claimed	Approved	Claimed	Approved
8	Rongnichu Hydro Power Plant	MBPCL	(Proposed to be approved in this Report)	113	Sikkim	Unit-I-25.06.2021 Unit-2-30.06.2021	9.58	9.29	4.69	3.41	14.27	12.70

5.12.3 MPBCL has claimed a Capital Cost of Rs. 14.27 Crore/MW in its Petition, with a claimed hard cost of Rs. 9.58 Crore/MW and IDC of Rs. 4.69 Crore/MW. The cost proposed to be approved in this Report works out to Rs. 12.70 Crore/MW, with an approved hard cost of Rs. 9.29 Crore/MW and IDC of Rs. 3.41 Crore/MW. Based on the above table, it appears that the Capital Cost proposed to be approved is within the benchmarking range for hydro power capital costs, including both hard costs and IDC. **Hence, the Capital Cost of Rs. 1,435.19 Crore proposed to be approved by ABPS may be allowed as the final capital cost as on COD for the Rongnichu Hydro Power Plant.**

Annexure 1 (Milestone-wise Summary submitted by MBPCL)

Sr. No.	Milestone activity	Sch. Start date	Sch. End date	Actual Start date	Actual End date	Delay in days	Reasons for delay
A	**Implementation Schedule**	**01-Oct-08**	**31-Mar-12**	**14-Jun-06**	**30-Jun-21**	**3378**	A delay of 3,378 days (approximately 111 months) occurred due to multiple factors, including delays in land acquisition and contract awards, natural disasters such as earthquakes and flash floods, slow progress caused by poor geological conditions and unforeseen geological surprises in the Head Race Tunnel (HRT) and underground penstock excavation, the Gorkha land agitation and the COVID-19 pandemic in 2019.
I	**Preconstruction Activities**	**01-Oct-08**	**30-Jun-09**	**14-Jun-06**	**30-Jun-14**	**1826**	
1	Land Acquisition	01-Oct-08	31-Mar-09	14-Jun-06	16-Jun-12	1173	Refer Enclosed **Annexure-I(a)** pertaining to detailed reasons for delay under land acquisition.
2	Tender and Contracts	01-Oct-08	31-Dec-08	30-Apr-09	14-Jul-12	1291	There was a delay of 43 months in the award of the contract due to delays in land acquisition and obtaining possession of the land.
3	Mobilization	01-Jan-09	31-Mar-09	01-Oct-10	31-Dec-10	640	There was a delay of 21 months due to delays in land acquisition and obtaining possession of the land.
4	Access roads and bridges	01-Nov-08	31-Mar-09	01-Oct-10	10-Mar-12	1075	There was a delay of 36 months due to delays in land acquisition and obtaining possession of the land.
5	Construction Camp	01-Jan-09	31-Mar-09	01-Oct-10	31-Dec-10	640	There was a delay of 21 months in the award of the contract due to delays in land acquisition and obtaining possession of the land.
6	Colonies	01-Jan-09	30-Jun-09	01-Oct-10	31-Mar-11	639	There was a delay of 21 months due to delays in land acquisition and obtaining possession of the land.

Sr. No.	Milestone activity	Sch. Start date	Sch. End date	Actual Start date	Actual End date	Delay in days	Reasons for delay
7	Quarries & Aggregate / Batch Plant	01-Jan-09	31-May-09	01-Oct-11	31-Dec-11	944	There was a delay of 31 months due to delays in land acquisition and obtaining possession of the land.
II	**Barrage Phase-1 Construction**	**01-Oct-09**	**31-Dec-09**	**01-Dec-11**	**31-May-14**	**1612**	I. The commencement of construction work was delayed by 25 months due to delays in land acquisition. II. Delays occurred due to a change in the location of the barrage, which was necessitated due to resistance from local residents against construction activities. III. Progress was significantly hampered due to poor geological conditions.
1	River Diversion	01-Oct-09	30-Nov-09	01-Dec-11	30-Apr-12	882	
2	Excavation	01-Nov-09	31-Dec-09	01-Dec-11	30-Apr-14	1581	
3	Concreting	01-Jan-10	31-May-10	01-Feb-12	31-May-14	1461	
	Barrage Phase-2 Construction	**01-Oct-10**	**31-Dec-11**	**01-Oct-14**	**30-Jun-21**	**3469**	
1.1	River Diversion	01-Oct-10	30-Oct-10	01-Oct-14	30-Nov-15	1857	
2.1	Excavation	01-Nov-10	31-Dec-10	01-Jan-16	30-Nov-18	2891	
3.1	Concreting	01-Jan-11	31-May-11	01-Jan-16	30-Jun-21	3683	
4	Gates & Hoists	01-Oct-11	31-Dec-11	01-Aug-17	31-May-21	3439	
III	**Intake Structure**	**01-Dec-09**	**31-May-11**	**01-Dec-11**	**31-May-21**	**3653**	This structure is associated with the barrage works. Therefore, the same reasons cited for delays in the barrage works are applicable to this structure as well.
1	Excavation	01-Dec-09	31-Jan-10	01-Apr-12	30-Jun-16	2342	
2	Concreting	01-Feb-10	31-Jan-11	01-Jun-16	30-Nov-18	2860	
3	Gates, Hoist & Trashrack	01-Feb-11	31-May-11	01-Aug-17	31-May-21	3653	
IV	**Feeder Tunnel**	**01-Apr-09**	**31-Jan-12**	**N.A.**			This structure was eliminated during the detailed design and engineering phase.
1	Adit Excavation	01-Apr-09	31-May-09	**N.A.**			
2	Excavation	01-Jun-09	30-Sep-09				
3	Concreting	01-Dec-11	31-Jan-12				
V	**Desilting Chambers**	**01-Oct-09**	**30-Nov-11**	**01-Dec-12**	**31-May-20**	**3105**	This structure is associated with the barrage works. Therefore, the same reasons cited for delays in the barrage works are applicable to this structure as well.
1	Excavation	01-Oct-09	31-Jan-11	01-Dec-12	30-Mar-18	2615	
2	Concreting	01-Feb-11	30-Nov-11	15-Dec-12	31-May-20	3105	
VI	**Gate Chamber**	**01-Oct-10**	**31-Jan-12**	**N.A.**			This structure was eliminated during the detailed design and engineering phase.
1	Adit Excavation	01-Oct-10	31-Jan-11	**N.A.**			
2	Chamber Excavation	01-Feb-11	31-Mar-11				

Sr. No.	Milestone activity	Sch. Start date	Sch. End date	Actual Start date	Actual End date	Delay in days	Reasons for delay
3	Gate and Hoist	01-Nov-11	31-Jan-12				
VII	**Silt Flushing Tunnel**	**01-Oct-10**	**30-Oct-11**	**N.A.**			This structure was eliminated during the detailed design and engineering phase.
1	Excavation	01-Oct-10	30-Apr-11	**N.A.**			
2	Pipe laying	01-May-11	30-Sep-11				
3	Valve	01-Oct-11	30-Oct-11				
VIII	**Head Race Tunnel**	**01-Mar-09**	**31-Dec-11**	**01-Apr-11**	**30-Apr-21**	**3408**	
1	Adit- 1 Excavation	01-Mar-09	31-Jul-09	01-Oct-12	05-Jul-13	1435	I. The commencement of construction work was delayed by 24 months due to delays in land acquisition. II. To address the issue of local resistance and refusal to part with their land, MBPCL identified a new location for Adit-1 and its approach road to avoid any further delays.
2	Adit- 2 Excavation	01-Mar-09	30-Jun-09	01-Mar-11	15-Dec-12	1264	The commencement of construction work was delayed by 29 months due to delay in land acquisition.
3	Adit- 3 Excavation	01-Mar-09	30-Jun-09	01-Aug-11	10-Jun-13	1441	The commencement of construction work was delayed by 42 months due to delays in land acquisition.
4	HRT Excavation	01-Jul-09	31-Jul-11	01-Dec-12	30-Nov-19	3044	I. The commencement of construction work was delayed by 42 months due to delays in land acquisition. II. Progress was slow due to poor geological conditions. III. Geological surprises, such as daylighting in the HRT near Adit-2 and cavity formations at various locations between Adit-2 and the Surge Shaft. IV. The availability of skilled manpower and supply of materials, especially cement and steel, were
5	Concreting	01-Feb-11	30-Oct-11	15-Dec-16	31-Mar-21	3440	
6	Grouting	01-Apr-11	30-Nov-11	01-Jan-19	31-Dec-20	3319	
7	Adit Plugs	01-Dec-11	31-Dec-11	01-Apr-21	30-Apr-21	3408	

Sr. No.	Milestone activity	Sch. Start date	Sch. End date	Actual Start date	Actual End date	Delay in days	Reasons for delay
							severely affected due to the Gorkhaland agitation (June 2017 to September 2017) and the COVID-19 pandemic (March 2020 to December 2020).
IX	**Surge Shaft**	**01-Mar-09**	**31-Dec-11**	**01-Oct-10**	**15-Jan-18**	**2207**	
1	Access road	01-Mar-09	31-May-09	01-Oct-10	10-Mar-12	1014	
2	Adit to surge shaft bottom	01-Jun-09	31-Jul-09	N.A.			The commencement of construction work was delayed by 33 months due to delays in land acquisition.
3	Excavation	01-Aug-09	30-Sep-10	01-May-12	30-Oct-13	1126	
4	Concreting	01-Oct-09	30-Sep-11	01-Mar-17	31-Dec-17	2284	
5	Grouting	01-Jul-11	30-Oct-11	01-Jan-18	15-Jan-18	2269	
6	Gates and Hoist	01-Nov-11	31-Dec-11	N.A.			
X	**Upper Horizontal Penstock**	**01-Mar-09**	**31-Mar-10**	**01-Oct-10**	**30-Apr-21**	**4048**	I. The commencement of construction work was delayed by 41 months due to delays in land acquisition. II. Progress was slow due to the shared approach for tunnelling and the erection of the penstock ferrule.
1	Access road	01-Mar-09	31-May-09	01-Oct-10	10-Mar-12	1014	
2	Penstock Excavation	01-Jun-09	30-Aug-09	01-Oct-12	30-Apr-13	1339	
3	Erection of Penstock / Concreting	01-Sep-09	31-Jan-10	01-Aug-20	30-Apr-21	4107	
4	Grouting	01-Feb-10	31-Mar-10	01-Dec-20	31-Dec-20	3928	
XI	**Lower Horizontal Penstock**	**01-Apr-09**	**30-Sep-10**	**01-Apr-11**	**28-Feb-21**	**3804**	I. The commencement of construction work was delayed by 18 months due to the delay in awarding the contract, which was caused by land acquisition issues for other associated components of the project. II. While a surface penstock was proposed in the DPR, the detailed design and engineering phase introduced an underground lower horizontal pressure shaft, 953 meters in length. III. The change in construction methodology from a surface penstock (approximately 950 meters) to an underground penstock (approximately 953 meters) resulted in a delay of 84 months for excavation, 128
1	Adit Excavation	01-Apr-09	30-Jun-09	**N.A.**			
2	Manifold Chamber excavation	01-Jul-09	30-Sep-09				
3	Penstocks excavation	01-Oct-09	30-Nov-09	01-Apr-11	31-Oct-16	2527	
4	Liner Erection / Concreting	01-Jun-10	30-Aug-10	01-Oct-18	28-Feb-21	3835	
5	Grouting	01-Sep-10	30-Sep-10	01-Jul-20	30-Sep-20	3653	

Sr. No.	Milestone activity	Sch. Start date	Sch. End date	Actual Start date	Actual End date	Delay in days	Reasons for delay
							months for the installation of the steel liner, and concreting.
XII	**Pressure Shaft/Vertical Pressure Shaft (VPS)**	**01-Dec-09**	**30-Oct-10**	**01-Apr-13**	**16-Mar-21**	**3790**	I. The commencement of construction work was delayed by 40 months due to delays in land acquisition. II. In the DPR, a 79 meter high pressure shaft was proposed, whereas in the detailed design and engineering phase, the alignment of the penstock changed from surface to underground, and a 318 meter high vertical pressure shaft was introduced. III. Due to the increase in vertical length, there was a delay of 105 months for excavation and 127 months for the installation of the steel liner and concreting. IV. Delays occurred due to poor geology, groundwater ingress, the Gorkhaland agitation, and the COVID-19 pandemic in 2019.
1	Excavation	01-Dec-09	27-Feb-10	01-Apr-13	30-Sep-18	3137	
2	Liner Erection /Concreting	01-Mar-10	31-May-10	01-Oct-18	31-Oct-20	3806	
3	Grouting	01-Oct-10	30-Oct-10	01-Mar-21	16-Mar-21	3790	
XIII	**Surface Penstocks**	**01-Oct-09**	**31-May-11**	**N.A.**			This structure was eliminated during the detailed design and engineering phase.
1	Excavation	01-Oct-09	31-Jan-11	**N.A.**			
2	Penstock erection / concreting	31-Dec-09	30-Apr-11				
3	Backfill and rehabilitation	01-Apr-10	31-May-11				
XIV	**Power House**	**01-Nov-09**	**30-Sep-11**	**28-09-11**	**30-06-21**	**3561**	I. The commencement of construction work was delayed by 36 months due to delays in awarding the contract and the finalization of the power house dimensions by the equipment manufacturer. II. The civil construction works of the power house complex could have been completed significantly earlier than construction of water conductor system
1	Excavation	01-Nov-09	31-Jan-10	01-Nov-12	30-Apr-14	1550	
2	Concreting	01-Feb-10	30-Apr-11	01-Dec-12	30-Jan-21	3563	
3	EOT Crane	01-Sep-10	30-Oct-10	28-Sep-11	24-Jan-19	3008	
4	Turbine & Generator	01-Nov-10	31-Jul-11	28-Sep-11	30-Jun-21	3622	
5	Spherical Valve	01-Feb-11	31-Jul-11	28-Sep-11	30-Jun-21	3622	

Sr. No.	Milestone activity	Sch. Start date	Sch. End date	Actual Start date	Actual End date	Delay in days	Reasons for delay
6	Auxiliary Equipment	01-Feb-11	30-Sep-11	28-Sep-11	30-Jun-21	3561	(HRT, VPS, and LHPS). However, since the water conductor system was identified as the critical path activity, the pace of construction of the power house complex was deliberately slowed down to reduce the capital cost incurred during the early phases of construction, in alignment with the schedule of the critical path activity. This was implemented to align with the overall project completion schedule as well as to minimize the Interest During Construction (IDC) costs. III. Skilled manpower and the supply of materials, especially cement and steel, were severely affected due to the Gorkhaland agitation (June 2017 to September 2017). IV. The project was delayed due to the power house approach road being washed away by flash floods from July 2015 to November 2015, and the Rangpo-Rorathang road to the power house approach road being collapsed from July 2019 to October 2019 which effected the transportation of construction materials and equipments.
XV	**Transformer Deck & TRC**	**01-Nov-09**	**31-May-10**	**01-Aug-16**	**31-May-17**	**2557**	The commencement of construction work was delayed by 82 months to align with the civil works of the power house.
1	Excavation	01-Nov-09	31-Jan-10	01-Aug-16	28-Feb-17	2585	
2	Concreting	01-Feb-10	31-May-10	16-Aug-16	31-May-17	2557	
XVI	**Tail Race Channel**	**01-Oct-10**	**27-Feb-11**	**01-Aug-16**	**31-May-17**	**2285**	The commencement of construction work was delayed by 71 months to align with the civil works of the power house.
1	Excavation	01-Oct-10	30-Nov-10	01-Aug-16	28-Feb-17	2282	
2	Concreting	01-Dec-10	27-Feb-11	16-Aug-16	31-May-17	2285	
XVII	**Switch Yard**	**01-Oct-10**	**30-Oct-11**	**01-Oct-17**	**30-Mar-21**	**3439**	
1	Civil Works	01-Oct-10	31-Jan-11	01-Oct-17	30-Oct-20	3560	

Sr. No.	Milestone activity	Sch. Start date	Sch. End date	Actual Start date	Actual End date	Delay in days	Reasons for delay
2	Equipment Installation	01-Feb-11	31-May-11	01-Nov-20	30-Mar-21	3591	The commencement of construction work was delayed by 85 months to align with the civil works of the power house.
3	Testing	01-Oct-11	30-Oct-11	01-Nov-20	30-Mar-21	3439	
XVIII	**Commissioning**	**01-Feb-12**	**31-Mar-12**	**13-Jun-21**	**30-Jun-21**	**3378**	The delays were caused by factors such as land acquisition issues, delays in the award of the contract, natural disasters such as an earthquake & flash floods, low progress due to poor geology and geological surprises in the HRT and underground excavation works, the Gorkhaland agitation, and the COVID-19 pandemic in 2019.